

1. INTRODUCTION

Ayurveda is the holistic health science. It describes not only the management of diseases but also prevention and to maintain health of healthy person. 'Dhatu Sarata' examination (examination of bone tissue excellency) is one of the most important parts of it. The Dhatu sarata examination is mainly based on darshan (inspection), sparshana (palpation and percussion) and prashna (interrogation or history taking) parikshana. But most of the part mentioned in Ayurved compendia is of subjective type. So it is necessary to search for any objective type of parameter.

Due to deteriorating quality of our eating habits and food stuff, lack of regular exercise people are suffering from early degenerative changes in the body. At premature age like thirty years people suffer from degenerative orthopedic problems like osteoarthritis, spondylosis, osteoporosis etc. To prevent these diseases it will be better if the person knows well in advance about the quantities of his bone tissue. Asthi-sarata examination will definitely guide the person about the quality of his bone tissue. Asthi-sarata examination is a need to give such type of guidance.

In this research project attempt is made to provide the supportive evidence for the Asthi-sarata. So whole research work is an attempt to find out whether Asthi-sarata can be determined by just examining a Bone-mass of a person? Let us find out answer of this question with the help of further pages in this dissertation.

2. AIM AND OBJECTIVES

AIM:

- 1) To provide parameter for Asthi-Sara examination.
- 2) To do the quantification of Asthi-Sarata level.
- 3) To find the relation between Asthi-Sara and Bone-Mass.

OBJECTIVES:

- 1) To follow the actual guidelines as per Ayurvedic classics for Asthi-sara examination.
- 2) To use Inner Scan Body Composition Monitor for determining Bone-Mass.

3. REVIEW OF LITERATURE

A. Ayurvedic review –

The Prakruti of an individual is determined on the basis of dominant Doshas that is on Dosha examination. Like this, strength of Dhatu has been examined by sarata examination. Charaka Samhita included sarata examination in "Dashavidha rogi Pariksha".

तस्मात्- आतुरं परीक्षेत प्रकृतिः-च, विकृतिः-च, सारतः-च, संहननतः-च, प्रमाणतः-च, सात्म्यतः-च, सत्त्वतः-च, आहार शक्तिः-च, व्यायाम शक्तिः-च, वयस्तः-च-इति, बलप्रमाणवि शेषग्रहणहेतोः ॥

च.वि.८/९४.

Patient should be examined so as to obtain knowledge regarding the degree of strength as –

- | | |
|--------------|-----------------|
| 1) Prakruti | 6) Satmya |
| 2) Vikruti | 7) Sattva |
| 3) Sara | 8) Aaharshakti |
| 4) Samhanana | 9) Vyayamshakti |
| 5) Pramana | 10) Vaya |

◆ SARA VIVECHAN

Nirukti: -

सृ + धत्

सार – अच वा (वाचस्पत्यम् भाग ६)

Vyakhya: - (आयुर्वेदीय शब्दकोश)

- १) सार-सत्त्व-अन्तर्गतः प्रधानभूतः अवयव विशेषः (सु.सू.४५/१२३)
- २) अन्तर्भागः (सु. क.७/३७)
- ३) बलम् (च.वि.८/९६)
- ४) स्थिरांशः कठिनो भागः (सु. भा. ५/२१)
- ५) सारः, त्रि (सृ + धत्)
- ६) मृत् (इ.अ.सं ३/२९)
- ७) उपरितनः स्निग्धो भागः (सु.उ.४०/१४५)
- ८) सार शब्देन विष्कृतो धातुः-उच्यते । (च.वि. ८/१०२ चक्रपाणी)
- ९) उत्कृष्टधातुत्वम्-उत्कृष्ट धातुर्वा (सु.सु.३५/१७)

All the meanings indicate the supreme or grand quality of Dhatu is Sara. Excellent quality of Dhatu is nothing but Sarata of that Dhatu.

In Charaka and Sushruta samhita vishudhatar Dhatu or utkrushta Dhatu are called as Sara. It means that the supremacy, Excellency and strongness of the Dhatu collectively called as Dhatu Sarata of that Dhatu.

- **Description of Sara Pariksha in different Ayurvedic text:-**

a) Charaka Samhita : -

Charaka included Sara examination in Vimansthana "Rogbhishgjiteey viman adhyay 8".

सारतःच-इति साराणि-अष्टौ पुरुषाणाम् बलमानवि षेज्ञानार्थम्-उपदि यन्ते ;

तद्-यथा त्वक्-रक्त-मांस-मेद-अस्थि-म - शुक्र-सत्त्वान्-इति ।

च.वि.८/१०२.

A patient should be examined for Sara to know certain kind of specific physical strength of that individual. On this basis individuals are examined into eight categories, depending upon the kind of excellence of their Dhatu as –

- 1) Tvaksara
- 2) Raktasara
- 3) Mamsasara
- 4) Medasara
- 5) Asthisara
- 6) Majjasara
- 7) Shukrasara
- 8) Sattvasara

b) Sushruta Samhita : -

In Sushruta Samhita Sara examination described in Sutrasthana "Aaturopkramneeyadhyay 35".

अथ सारान् वक्ष्याम :-

स्मृति-भक्ति-प्रज्ञा- गौच- गौर्य-उपेतम् कल्याण-अभिनिवे ि सत्त्वसारं विद्यात ;

स्निग्ध-संहत-श्वेत-अस्थि-दंत-नखं बहुलकामप्रजं गुक्तेण ;

अकृ त्-उत्तमबलं स्निग्धगंभीरस्वरं सौभाग्य-उपपन्नं महानेत्रं च म ि ;

महािरः स्कन्ध दृढ-दन्त-हनु-अस्थि-नखम्-अस्थिभिः ;

स्निग्धमूत्रस्वेदस्वरं बृहत्- रीरम्-आयास-असहिष्णुं मेदसा ;

अच्छिद्रगात्रं गूढ-अस्थि-संधिम् मांस-उपचितं च मांसेन ;

स्निग्ध-ताम्र-नख-नयन-तालु-जिह्वा-ओष्ठ-पाणिपादतलं रक्तेन ;

सुप्रसन्न-मृदु-त्वक्-रोमाणं त्वक् सारं विद्यात् इति ।

एषां पूर्वं पूर्वं प्रधानम्-आयुः सौभाग्ययोः-इति ॥

सु.सू. ३५/१६.

As like Charaka, Sushruta explain eight types of Sara-

- 1) Sattvasara
- 2) Shukrasara
- 3) Majjasara
- 4) Asthisara
- 5) Medasara
- 6) Mamsasara
- 7) Raktasara
- 8) Tvaksara

c) Ashtang Samgraha : -

In Ashtang Samgraha Sara examination is described as of eight kinds to determining the degree of strength of Dhātu in Sharīrsthān "Prakṛtibhediyaadhyāy 8".

तथा साराणि:-अष्टौ त्वक्-रक्त-मांस-मेद-अस्थि-म - पुक्र-सत्त्वात्मकानि-उत्तरोत्तर

वराणि बलमानज्ञानार्थम्-उपदि यन्ते ।

अ.सं. ॥८/२७.

- 1) Tvaksara
- 2) Raktasara
- 3) Mamsasara
- 4) Medasara
- 5) Asthisara
- 6) Majjasara
- 7) Shukrasara
- 8) Sattvasara

d) Ashtang Hridaya : -

According to Ashtang Hridaya Sara examination is described in Sharirsthan "Angvibhag adhyay 3".

त्वक् -रक्त-आदिनि सत्त्वान्-तानि-अग्रथाणि-अष्टौ यथा-उत्तरम् ।

बलप्रमाणज्ञानार्थं साराणि-युक्तानि देहिनाम् ॥

सारे-उपेतः सर्वैः स्यात्परं गौरव-संयुतः ।

सर्व-आरंभेषु च-आ तावान्-सहिष्णुः सन्मतिः स्थिरः ।

अ.ह. ॥३/११८.

For knowledge of degree of strength of an individual, there are also eight types of Sara examined as -

- 1) Tvaksara
- 2) Raktasara

- 3) Mamsasara
- 4) Medasara
- 5) Asthisara
- 6) Majjasara
- 7) Shukrasara
- 8) Sattvasara

e) Kashyap Samhita : -

According to Kashyap Samhita sara is described in
"Lakshanadhyay 28" in Sutrasthana.

त्वक्-असृङ्-मांस-मेद-अस्थि म - पुक्ताणि धातवः ।

ओजः सत्त्वं च सर्वं च तत्-सारं तु निबोध मे ॥

का.सं.सू. २८/९.

- 1) Tvaksara
- 2) Raktasara
- 3) Mamsasara
- 4) Medasara
- 5) Asthisara
- 6) Majjasara
- 7) Shukrasara
- 8) Sattvasara
- 9) Ojasara

- **Need for examination of Sara –**

कथं नु रीरमात्रद नात्-एव भिषङ्म्-उह्येद्-अयम्-उपचितत्वाद् बलवान्,

अयम्-अल्पबलः कृ त्वात्, महाबलाःअयम् महा रीरत्वात् ;

अयम्-अल्प रीरत्वात्-अल्पबल इति ; दृ यन्ते हि-अल्प रीराः कृ णःच-एके बलवन्तः ;

तत्र पिपीलिकाभारहरणवत् सिद्धिः । अतःच सारतः परीक्षेत्-इति उत्तम् ॥

च.वि.८/११५.

Sometimes the physician may take a wrong decision only by looking at the body or appearance, such as he is weak because of leanness; he is very strong because of possessing a big body. But it is observed that some persons having small body and leanness are strong like the small ants carrying a big load. Hence one should examine with reference to excellence of his Dhatus.

इति साराणि-अष्टौ पुरुषाणां बलप्रमाणवि शेषज्ञानार्थम् उपदिष्टानि भवन्ति ।

च.वि.८/११४

Eight types of Sara have been described for the knowledge of the degree of strength of an individual.

वि शेषतः-अ ण् प्रत्य ण् प्रमाणात्-अथ सारतः ।

परीक्ष्य-आयुः सुनिपुणो भिषक् सिध्यति कर्मसु ॥

सु.सू.३५/१७.

The expert physician succeeds in his work, if he proceeds after examining the life span particularly on the basis of measurement of parts and subparts of body and essential predominance of dhatus etc.

तत्र तावद्-इयं बलदोषप्रमाणज्ञानहेतो दोषप्रमाण-अनुरूपो हि भेषजप्रमाणविकल्पो

बलप्रमाणवि षे-अपेक्षो भवति ॥ तथा बलवति बलवद् व्याधिपरिगते । स्वल्पबलम्-औषधम्-

अपरिक्षक प्रयुक्तम्-असाधकम्-एव भवति ॥

च.वि.८/९३.

According Charaka, person should be examined so as to obtain knowledge regarding the strength and after that the dosage of the therapy is determined.

◆ Dhatu Vivechan

Nirukti: -

१) धृ-धारयति । दधाति ।

धारयति रीरसंवर्धकान् इति धातु ।

२) रीरदूषणाद् दोषा मलिनीकरणात्-मलाः ।

धारणाद् धातवः-ते स्युः-वात-पित्त- कफाः -त्रयः ॥

इति वैदकम्

३) एते सप्त स्वयं स्थित्वा देहन्दधति यत्-नृणाम् ।

रस-अस् -मांस-मेद-अस्थि-म - ण्क्राणि धातवः ॥

भा.प्र.पू.खंड ३/१३३.

४) रस-अस् -मांस-मेद-अस्थि-म - ण्क्राणि धातवः ।

सप्तदूष्याः मलामूत्रा कृद्-स्वेद्-आदयः-अपिच ॥

अ.ह.सू.१/१३

५) रीरधारणात् धातव इति-उच्यते ।

सु.सू.१४/२०.

धातु ादेन धारणं पोषणं च इह विविक्षितम् ।

उल्हण टीका सु.सू. १४/२०.

Entity that sustains and grows, nourishes the body is called Dhatu. Rasa, Asruk, Mamsa, Meda, Asthi, Majja and Shukra are called seven Dhatus (primary/basic tissues) since these stay firm and support the human body.

They (Rasa, Asruk etc.) are called Dhatus as they sustain the body. However Dosha, Mala and Upadhatu are only support or sustain body and dose not nourishes anybody.

In Sam-avastha all three entities Dosha-Dhatu-Mala sustain body and for this reason are called 'Tridhatu'.

Dhatu and Mala are under control of Dosha. But if Dhatus are strong enough 'Dosha' cannot start pathogenesis even after their imbalance. Only deficiency of these (Dhatu) makes vitiated Dosha to start events of pathogenesis. Thus Dhatu provide immune mechanism to body and resists diseases.

Shivdas Sen told the difference between Dhatu and Upadhatu as Dhatu sustain and nourishes body while Upadhatu sustain only and does not nourishes body.

Panchabhutikatwa of Dhatu:-

- 1) Rasadhatu - Aapa
- 2) Raktadhatu - Tejas + Aapa
- 3) Mamsadhatu - Parthiva
- 4) Medadhatu - Parthiva + Aapa
- 5) Asthidhatu - Parthiva + Vayu
- 6) Majjadhatu - Aapa
- 7) Shukradhatu - Aapa

Dhatu – Uttapatikrama: -

तत्र-आहार-रसो व्यानविक्षिप्तो यथास्वं सप्तसु धातु-अग्निषु-क्रमात्-पच्यमानः

स्व-आत्मभाव प्रच्युति समनन्तरम्-एव प्राप्त रक्तादिधातु-संज्ञकः

कालवत्-अस्खलित बलप्रमाणो देहम्-उर्जयित्वा धातून्-धातुमलान्च पुष्पाति ॥

अ.सं. ॥.६/२८.

The essence of food transported by Vyana (through the strotas to the seven Dhatus) undergoes further transformation by the seven Dhatvagni in proper order, casts off its previous qualities and assumes new ones, identical with themselves: both (these activities) taking place simultaneously and becomes known as Dhatus such as Rakta and others, maintaining an uninterrupted strength and quality. This (Rasa) supports / sustains the body and nourishes the Dhatus (tissues) and the Dhatumalas.

स्थूलः सूक्ष्मः-तत्-मलाः च तत्र तत्र त्रिधारसः ।

स्वं स्थूलो-अं ऽः परं सूक्ष्मः-तत्-मलोयाति तत्-मलम् ॥

भा.प्र.पू.खंड ३/१७७

Aahararasa produced from digested food is circulated through each Dhatu. It is divided in three forms: viz Sthula, Sukshma and Mala. Out of which sthulansha is present in same Dhatu and sukshmansha is converted into next Dhatu while malansha create the Mala of that Dhatu.

रसात्-रक्तं ततो-मांसं मांसात्-मेदः-ततो-अस्थि च ।

अस्थो-म ततः णुक् णुक्दगर्भः प्रसादजः ।

च.चि.१५/१६.

The nutrient fraction of Rasa provides nourishment to Rakta, that of Rakta to Mamsa, that of Mamsa to Meda, that of Meda to Asthi, that of Asthi to Majja and the nutrient fraction of Majja provides nourishment to Shukra. The foetus is the product of nutrient fraction of Shukra (Semen).

Trividh Dhatu Utpatti Nyaya: -

- 1) Kshira-Dadhi Nyaya:- The law of transformation.
- 2) Kedarkulya Nyaya:- The law of irrigation.
- 3) Khalekapota Nyaya:- The law of selectivity.

1) Kshira-Dadhi Nyaya -

According to this concept, the preceding Dhatu get transformed into the succeeding Dhatu. Rasa is digested by swa-agni and is bio-converted into Rakta. Due to swa-agni Rakta is transported into Mamsa. In such fashion previous Dhatu generates next Dhatu due to bio-conversion by swa-agni. This is on the analogy of transformation of milk into curd, curd into butter and butter then is bio-converted into ghee. This is complete conversion of one entity into another. So it is called Kshira-Dhadhi Nyaya or total bioconversion law that is Sarwatmaparinam Nyaya.

2) Kedar-kulya Nyaya -

According to this theory, the process of nourishment of tissue depends on irrigation law. Nourishing fluid Rasa replenishes Rakta in the beginning. Whatever part of Rasa is necessary for Rakta is offered to Rakta Dhatu in Raktavaha strotas. When Rakta takes out its own replenishment, Rasa replenishes Mamsa. In this way, the nourishment is taken by all the Dhatus by Aahararasa in order.

This is comparable to watering the field. When watering canal provides water to field, portion of field craves for water sucks the water through channel. Hence this law is called channel and field or Kedar-kulya Nyaya, where Kedar means field and kulya means channel.

3) Khale-kapot Nyaya -

According to this concept, the nourishment of Dhatus takes place by selection. In this, Khale means storage and kapot means bird. Just as bird picks up what it need from storage, every Dhatu picks up required nourishment from store house like Aahararasa, which supplies to each Dhatu as per their own selection and need. When Aahararasa travels through all channels, the one who is near gets replenished earlier and the one who is far gets his nourishment later. Aahararasa initially replenishes Rasa then Rakta Dhatu, afterwards Mamsa Dhatu and consecutively all Dhatavah till last Dhatu Shukra.

Dhatu Parinati Kal: -

षडभिः केचित्-अहोरात्रैः-इच्छन्ति परिवर्तनम् ।

संतत्या भोज्यधातूनां परिवृत्तिःतु चक्रवत् ॥

च.चि.१५/२०.

According to some scholars, the transformation of dhatus is effected in six days and nights. This process of transformation of the tissue elements requiring nourishment is a continuous one, like a moving wheel.

स खलु त्रीणि त्रीणि कला सहस्राणि पञ्चद । च कला एक-एक-अस्मिन्

धाताव्-अवतिष्ठते ; एवं मासेन रसः पुनः स्त्रीणां च आर्तवम् भवति ॥

सु.सू.१४/१५.

That (aahararasa) stays in each dhatu for three thousand and fifteen Kalas, thus in a month, Rasa becomes shukra (semen) in male and aartava (mense) in women.

तदनन्तरं (रसानन्तरं) ये षड्धातवः ते प्रत्येकं पंचभिः पंचभिः अहोभिः सम्पद्यन्ते ।

सु.सू.१४/१५

According to Sushruta after formation of ahararasa, every dhatu is formed serially on every 5th day. Rasa dhatu is formed on 1st day of ingestion of food and on every 5th day, other new dhatu is formed. Hence Shukra dhatu is formed on 30th day.

आहारःअद्यतनःश्वः हि रसत्वं गच्छति नृणाम् ।

गोणितत्वं तृतीये-अहि, चतुर्थे मांसताम्-अपि ॥

मेदत्वं पञ्चमे, षष्ठे तु-अस्थित्वं, सप्तमे तु-यियात् ।

म तां, पुक्रतां याति नियमात्-अष्टमे नृणाम् ॥

पारा १२

Parashara opines that food becomes Rasa on next day, Rakta on third day, Mamsa on fourth day, Meda on fifth day, Asthi on sixth day, Majja on seventh day and Shukra on eighth day.

केचित्त-अहुःअहोरात्रात् षडहात्-अपरे, परे । मासेन याति पुक्रत्वम् अन्नं पाकक्रमादिभिः ॥

अ.ह. ॥.३/६६.

Some (authorities) say, that the food gets converted to Shukra (last dhatu) in one day; some say, after six days; and yet others, after one month, after undergoing series of paka (digestion and transformation).

Dhatu Pramana: -

- 1) Rasa – 9 anjali
- 2) Rakta – 8 anjali
- 3) Meda -2 anjali
- 4) Majja – 1 anjali
- 5) Shukra – ½ anjali.

Upadhatu of Dhatu: -

रसात् स्तन्यं ततो रक्तम्-असृजः कण्डराः सिराः ।

मांसाद्-वसा त्वचः षट् च मेदसः स्नायुसम्भवः ॥

च.चि.१५/१६.

Stanya (breast milk) and rajas (menstrual blood) are formed out of Rasa, kandara (tendons) and seera (vessels) are formed out of Rakta, vasa (muscle fat) and six layers of skin are formed out of Mamsa and snayu(senew) are formed out of Medadhatu.

According to Sharagdhara Samhita:-

स्तन्यं रजः च नारीणां काले भवति गच्छति ।

गुब्धं मांसं स्नेहः सा वसा परीकीर्तिता ।

स्वेदो दन्ताः तथा के ऋः-तथा-एव-ओजाः च सप्तमम् ।

इति धातुभवा ज्ञेया एते सप्त-उपधातवः ॥

भा.पू. खंड ५/२८, २९.

Stanyam (breast milk), raja (menstrual blood) in women, the oily part of Mamsa (muscle) which is known as vasa (lipid);

sweat, teeth and hair are the six and seventh one Ojas are the by-product of seven Dhatus and known as Upadhatus.

Dhatu Mala: -

१) किं मूत्र-अन्नस्य विट्-मूत्रं रसस्य तु कफः असृजः ।

पित्तं, मांसस्य खमला, मलः स्वेदः तु मेदसः ॥

स्यात्किं केऽलोम-अस्थो मज्जः स्नेहः-अक्षि-विट् त्वचाम् ।

प्रसादकिं धातूनां पाकाद्-एवं-विधर्च्छतः ॥

च.चि.१५/१८,१९.

२) विट्-मूत्रं-आहार-मलः सारः प्राणीरितो रसः ।

सु.सू.४६/५२६.

३) कफः पित्तं मलः खेषु स्वेदः स्यात्-नख-रोम च ।

नेत्र-विट् त्वक्षु च स्नेहो धातूनां क्रमजो मलाः ॥

सु.सू.४६/५२७.

४) कफः पित्तं मलाः खेषु प्रस्वेदो नख-रोम च ।

स्नेहः अक्षि-त्वक्-विजाम्-ओजो धातूनां क्रमजो मलाः ॥

अ.ह.जा.३/६३.

Kapha, pitta, dirt in passages (khamala), sweat, nails and hairs, dirt of eye and oiliness in skin these are excretions of Dhatus in respective order of Rasa, Rakta, Mamsa, Meda, Asthi and Majja.

Also Ashtanga Hridaya describe Oja is the Mala of Shukra Dhatu.

According to Sharangdhar -

जिह्वा नेत्र कपोलानां जलं पित्तं च रन्जकम् ।

कर्ण-विट्-रसना-दंत कक्षा-मेढ्रादिजं मलम् ॥

नख-नेत्र-मलं वक्त्रे स्निग्धत्वं पिटिकाः-तथा ।

जायन्ते सप्तधातूनां मलानि-एव-अनुक्रमात् ॥

कफः पित्तं मलं खेषु प्रस्वेदो नख-रोम च ।

नेत्रविट् त्वक्षु च स्नेहो धातूनां क्रम ॥ मलः ॥

॥.पू. खंड ५/२५, २६

The moisture of the tongue, eyes, mouth, the ranjaka pitta, the excretions of the ears, eyes, tongue, teeth, axilla, genitals, nails; pimples, greasiness of the skin of the face etc. are the waste products of the dhatus (tissue) respectively. Kapha, pitta, khamalas (excretions from open orifices, tissue pores), sweda (sweat), nakha (nails), roma (hair), the lubricating material of the eyes excreta and skin; these seven are the wastes of the seven dhatus respectively.

Dhatu karya (function): -

रसःतुष्टिं प्रीणनं रक्तपुष्टिं च करोति । रक्तवर्णप्रसादं मांसपुष्टिं जीवयति च ।

मांसं । रीरपुष्टिं मेदसःच । मेदः स्नेह-स्वेदौ दृढत्वं पुष्टिम्-अस्थनां च ।

अस्थीनि देहधारणं मज्जःपुष्टिं च । म । स्नेहं बलं । उक्रपुष्टिं पूरणम्-अस्थनां च करोति ।

उक्रं धैर्यं च्यवनं प्रीतिं देहबलं हर्षं बीजार्थं च ॥

सु.सू. १५/७.

Rasa dhatu supply nutrients to Rakta dhatu (blood) and satisfy all parts of body, blood offers luster to skin complexion, nourishes Mamsa (muscles tissue) and sustains life; muscles strengthens the body and nourishes Meda; Meda gives rise to unctuous materials, sweat, firmness and nourishes Asthi (bone); Asthi support the body and nourish Majja (marrow); majja provides unctuous, strength, nourishes Shukra (semen) and Shukra dhatu provides valour, discharge, pleasure, physical strength, exhilaration and is meant for seed (reproduction).

प्रीणनं जीवनं लेपः स्नेहो धारण-पूरणे ।

गर्भ-उत्पादः च कर्माणि धातूनां क्रमो विदुः ॥

अ.सं.सू.१/३०.

प्रीणनं जीवनं लेपः स्नेहो धारण-पूरणे ।

गर्भ-उत्पादः च धातूनां श्रेष्ठं कर्म क्रमात्स्मृतम् ॥

अ.ह.सू.११/४.

Dhatu and their functions----

Rasa - Preenana (Gratification).

Rakta - Jeevana (Maintenance of life).

Mamsa - Lepana (To cover various organs)

Mada - Snehana (Lubrication)

Asthi - Dharana (To support)

Majja - Purana (To fill the bony cavity)

Shukra - Garbhotpadana (Reproduction).

Dhatu Sarata:-

1) Rasa -Sara : -

तत्र स्निग्ध- लक्षण-मृदु-प्रसन्न-सूक्ष्म-अल्पगम्भीर-सुकुमारलोमा सप्रभा-एव च त्वक् त्वक्-
साराणाम् । सा सारता सुख-सौभाग्य-ऐश्वर्य-उपभोग-बुद्धि-विद्या-आरोग्य-प्रहर्षणानि आयुष्यत्वम्
च-आचष्टे ॥

च.वि.८/१०३.

Individuals having excellence of tvak or skin are characterized by unctuous, smooth, soft, clear, fine, few, sparse, deeply rooted hair and lustrous skin. Such individuals are endowed with happiness, good fortune, wealth, enjoyment, intellect, knowledge, health, excitement and longevity.

सुप्रसन्न-मृदु-त्वक्-रोमाणं त्वक् सारं विद्यात् इति ।

सु.सू. ३५/१६.

According to Sushruta tvak sara person have glistening and soft skin and hairs.

2) Rakta-Sara : -

कर्ण-अक्षि-मुख-जिह्वा-नासा-ओष्ठ-पाणिपादतल-नख-ललाट-मेहनं स्निग्ध-रक्तवर्णं श्रीमद्-
भ्राजिष्णु रक्तसाराणाम् । सा सारता सुखं-उद्धतां मेधां मनस्वित्वं सौकुमार्यम्- अनतिबलम्-
अक्ले त्सहिषुत्वम् उष्ण-असहिषुत्वं च-आचष्टे ॥

च.वि.८/१०४.

Individuals having excellence of Rakta dhatu are characterized by unctuousness, red colour, beautiful, dazzling appearance of the ears, eyes, face, tongue, nose, lips, sole of the hands and feet, nails, forehead and genital organs. Such individuals are endowed with happiness, great genius, enthusiasm, tenderness and moderate strength. They cannot sustain strenuous job and hot climate.

स्निग्ध-ताम्र-नख-नयन-तालु-जिह्वा-ओष्ठ-पाणिपादतलं रक्तेन ;

सु.सू. ३५/१६.

According to Sushruta Rakta sara person has unctuous and coppery nails, eyes, palate, tongue, lips, palm and soles.

3) Mamsa-Sara :-

शिरः-ललाट-कृकाटिका-अक्षिगण्ड-हनु-ग्रीवा-स्कन्ध-उदर-कक्ष-वक्षः पाणिपादसंध्यः स्थिर-
गुरू-मांस-उपचिता मांससाराणाम् । सा सारता क्षमां धृतिम्-अलौल्यं वित्तं विद्यां सुखं-आर्जवम्-
आरोग्यं बलम्-आयुः दीर्घम्-आचष्टे ॥

च.वि.८/१०५.

Temples, forehead, nape, eyes, cheeks, jaws, neck, shoulder, abdomen, axillae, chest and joints of an individuals who is endowed with Mamsa sarata, are heavy, firm and properly covered with Mamsa dhatu. Such individuals are endowed with forgiveness, patience, non-greediness, wealth, knowledge, happiness, politeness, simplicity, health, good strength and longevity.

अच्छिद्रगात्रं गूढ-अस्थि-संधिम् मांस-उपचितं च मांसेन ;

सु.सू. ३५/१६.

According to Sushruta Mamsa Sara person's body is without any dipression, the joints are concealed and muscles are well developed.

4) Meda-Sara :-

वर्ण-स्वर-नेत्र-के ।-लोम-नख-दन्त-ओष्ठ-मूत्र-पुरीषेषु वि षेः स्नेहो मेदः साराणाम् ।

सा सारता वित्त-ऐश्वर्य-सुख-उपभोग-प्रदानानि-आर्जवं सुकुमार-उपचरतां च-आचष्टे ॥

च.वि.८/१०६

Individuals having excellence of the Meda or adipose tissue are characterized by the abundance of unctuousness in complexion, voice, eyes, hair of the head and other parts of the body, nails, teeth, lips, urine and feces. Such individuals are endowed with wealth, power, happiness, enjoyment, charity, simplicity. They are very delicate (withstand hard work) hence unable to bear physical strain.

स्निग्धमूत्रस्वेदस्वरं बृहत्- ।रीरम्-आयास-असहिष्णुं मेदसा ;

सु.सू. ३५/१६.

According to Sushruta, one with predominance of Meda (fat) has unctuous urine and sweat, melodious voice, fleshy body and intolerance to exertion that is such person cannot perform hard work.

5) Asthi-Sara :-

पाष्णि-गुल्फ-जानु-अरलि-जत्रु-चिबुक-रिः पर्वस्थूलाः स्थूल-अस्थि-नख दन्ताः च अस्थिसाराः ।

ते महा-उत्साहाः क्रियावन्तः क्लेशाः सार-स्थिर- रीरा भवन्ति-आयुष्मन्तः च ॥

च.वि.८/१०७

Heels (parshni), ankles (gulpha), knee joints (janu), forearms (aratni), collar-bones (jatru), chin (chibuka), head, joints (parva), bones, nails and teeth, these part of asthi sara person are larger and stronger. Such individuals are very enthusiastic in nature. Since the bones gives good strength and power, these persons can carry out heavy manual work or exercise. They are endowed with stable body and longevity.

महारिः स्कन्ध दृढ-दन्त-हनु-अस्थि-नखम्-अस्थिभिः ;

सु.सू. ३५/१६

According to Sushruta head, shoulders, teeth, mandibles, nails, bones are prominent and large size in asthi sara person.

6) Majja-Sara :-

मृदु-अ त बलवन्तः स्निग्ध-वर्ण-स्वराः स्थूल-दीर्घ- वृत्त-सन्ध्याः च म साराः ।

ते दीर्घ-आयुषो बलवन्तः श्रुत-वित्त-विज्ञान-अपत्य-सम्मानभाजः च भवन्ति ॥

च.वि.८/१०८.

Person endowed with best quality of Majja sarata has soft skin and strong body. Complexion of such person is unctuous, voice is sweet. Joints are big, long and rounded. Such individuals are

endowed with longevity, strength, learning, wealth, creativity; he loves children and gets respect in society.

अकृ ण्-उत्तमबलं स्निग्धगंभीरस्वरं सौभाग्य-उपपन्नं महानेत्रं च म ा ;

सु.सू. ३५/१६.

According to Sushruta big eyes (maha netra) is a differentiating symptom of majja sarata.

7) Shukra -Sara :-

सौम्याः सौम्यप्रेक्षिणः क्षीरपूर्णलोचना इव प्राहर्षबहुलाः स्निग्ध-वृत्त-सार-सम-संहत-खिर द णाः

प्रसन्न-स्निग्ध-वर्ण-स्वरा भ्राजिष्णवो महास्फिचः च गुक्रसाराः ।

ते स्त्री-प्रिय-उपभोगा बलवन्तः सुख-ऐश्वर्य-आरोग्य-वित्त-सम्मान-अपत्य-भाजः च भवन्ति॥

च.वि.८/१०९

Individuals having excellence of Shukradhatu are characterized by gentleness, gentle look, having eyes to be filled with milk, cheer-fullness. Such person has unctuous, rounded, compact, smooth edged, white straight and strong teeth. Complexion of shukra sara person is fresh and unctuous, soft and sweet voice, skin is very radiant (bhrajishnu). Also sukra sara person has broad pelvis (maha sphik). Such individuals are popular in women. They have good physical and sexual strength. Shukra sara person are endowed with happiness, power, health, wealth, children, honour and progeny.

स्निग्ध-संहत-श्वेत-अस्थि-दंत-नखं बहुलकामप्रजं गुक्रेण ;

सु.सू. ३५/१६.

According to Sushruta, Shukra sara person has unctuous, compact and white bone, teeth, and nails with enhanced sex and numerous progeny.

8) Sattva -Sara :-

स्मृतिमन्तो-भक्तिमन्तः कृतज्ञाः प्राज्ञाः पुचयो महा-उत्साहा दक्षाधीराः

समराविक्रान्तयोधिनःत्यक्तविषादाः सुव्यवस्थित गतिगंभीर बुद्धिचेष्टाः कल्याण-अभिनिवेदिनःच

सत्त्वसाराः। तेषां स्वलक्षणैःएव गुणा व्याख्याताः॥

च.वि.८/११०.

Individuals having excellence of mental faculties are characterized by good memory, devotion, gratefulness, wisdom, purity, excessive enthusiasm, skill, courage, valor in fighting, absence of sorrow, proper gait and depth of wisdom and sincerity in actions and virtuous acts.

स्मृति-भक्ति-प्राज्ञा- गौच- गौर्य-उपेतम् कल्याण-अभिनिवेदिनः सत्त्वसारं विद्यात ;

सु.सू. ३५/१६.

According to Sushruta, one who possesses memory, devotion, wisdom, purity and valour with tendencies in welfare activities should be known as essentially predominant in Sattva.

9) Sarva –Sara :-

तत्र सर्वैः सारैः उपेताः पुरुषा भवन्ति-अतिबलाः परमसुखयुक्तः क्लेशहाः सर्व-आरंभेषु-आत्मनि
जातप्रत्यताः कल्याण-अभिनिवेदिनः स्थिर-समाहित गीराः सुसमाहितगतयः स-आनुनाद-स्निग्ध-
गंभीर-महास्वराः सुख-ऐश्वर्य-वित्त-उपभोग संमानभाजो मन्दजरसो मन्दविकाराः प्रायः तुल्यगुण
विस्तार्ष-अपत्याः चिर जीविनः च ॥

च.वि.८/१११.

Individual possessed of the excellence of all the above mentioned dhatus including mental faculties are endowed with great strength and happiness, resistance to difficulties, self-confidence in all enterprises, virtuous acts, firm and well built body, correct gait; resonant, melodious and high pitched voice, happiness, power, wealth, enjoyments, honour, slowness of aging process, resistance for diseases, large number of children with similar qualities and longevity.

◆ Asthi Dhatu

Vyutpatti:-

अस्यते अस + कथिन ।

मांस-अभ्यन्तरस्थे (हाड) इति ख्याते धातुभेदे ।

(।ब्दकल्पद्रुम)

The word "Asthi" is derived from verb अस्यते | which mean to remain. Asthi Dhatu persists in the same form and structure after death as compared to other Dhatu. That's why it is called as 'Asthi'. It is a hard substance, which is present inside the muscle tissue.

Nirukti:-

अभ्यन्तरगतैः सारैः-यथा तिष्ठन्ति भूरुहाः ।

अस्थिसारैः तथा देहात्-ध्रियन्ते देहिनां ध्रुवम् ॥

वाचस्पत्यम्

As trees stand with the help of inner hard core of Sara, human being also stands with the help of inner hard core named 'Asthi'.

Paryaya (synonyms):-

Keekasa, Kulya, Medoja and Haddam are the synonyms of Asthi Dhatu.

Utpatti of Asthi Dhatu:-

Asthi Dhatu is fifth Dhatu amongst seven. It gets generated in intra-uterine life. Growth and nourishment is by food just like any other Dhatu.

When Medodhatu takes its origin in Medovahastrotas, Medodhatwagni acts on its nutriments coming from Aahararasa and from Mamsavahastrostas. Medodhatu is produced in Medovahastrotas. Part of Medodhatu reaches next strotas that is Asthivahastrotas; it takes part in production of Asthi Dhatu. Nutrients coming from Aahararasa and from Medovahastrostas are acted upon, by Asthidhatwagni and give rise to Asthi Dhatu proper. From this Asthi Dhatu its Upadhatu is generated. Mala of Medodhatu gets also produced.

पृथिवि-अग्नि अनिल-आदीनां संघातः स्व-उष्मणा कृतः।

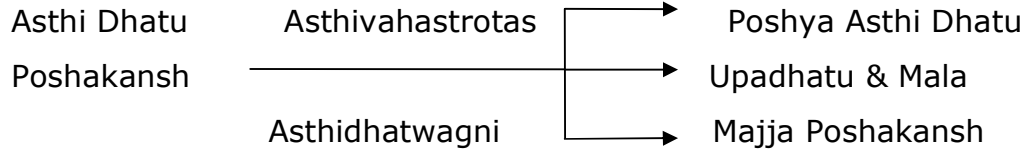
खरत्व प्रकरोति-अस्य जायते-अस्थि ततो नृणाम् ॥

च.चि. १५/३१

Asthidhatwagni acts on Prithvi, Agni and Vata predominant portions of nutriments and digests this bringing hardness to it. From this is generated Asthi Dhatu.

Medodhatu is fluidly Dhatu and it is unctuous. From Medodhatu, to produce hard Asthi, Vayu is needed for drying the fluidity; Prithvi is needed for bringing down fluid Meda to solid Asthi; Teja is needed for bringing down khara or rough property.

As per law of nourishment of Dhatu, Asthi Dhatu is nourished by three ways. Asthidhatwagni acts on nutrients reaching it strotas, giving rise to Asthi Dhatu.



Garbh utpadak bhava:-

तत्र गर्भस्य पितृज-मातृज-रसज्-आत्मज-सत्वज-सात्मजानि ।रीरलक्षणानि व्याख्यास्यामः।

गर्भस्य के ।- मश्रु-लोम-अस्थि-नख-दन्त-सिरा-स्नायु-धमनीरेतः प्रभृतीनि स्थिराणि

पितृजानि,

सु. ॥.३/३३.

According to Sushruta, different parts and principles of body of foetus are contributed by the paternal element, maternal factor, the serum (Rasaja), the soul (Atmaja), the mental (Sattvaja) and the advantageous physiological conditions (Satmyaja).

- **Pitruja bhava -**

The hairs of the head and body, beard and moustaches, **bones**, nails, teeth, veins (sira), nerves, arteries (Dhamani), semen and all the steady and hard substances (in the organism of child) are contributed by the paternal element in the conception Pitruja;.

Asthi dhatu utapatti kala (time):-

According to Charaka, Asthi dhatu is formed on 5th day after ingestion of food.

According to Parashar, Asthi dhatu is formed on 6th day.

According to Sushruta, Asthi dhatu is formed on 20th day.

Panchbhautika constitution of Asthi dhatu:-

अस्थि पृथिवि-अनिलात्मकम् ।

भानुमति टीका सु.सू.१५/८

In spite of presence of all five mahabhutas, Asthi has predominance of prithvi and vayu mahabhuta.

Types of Asthi:-

- 1) Nalakasthi - Long bones
- 2) Kapalasthi - Flat bones
- 3) Mandalakar Asthi - Vertebrae, ribs
- 4) Ruchakasthi - Teeth
- 5) Tarunasthi - Cartilage.

Asthi Dhatu Samkhya:-

Aatreya sampraday - 360

Dhanvantari sampraday - 300

Modern science - 206

Moola sthan (location) of Asthi Dhatu:-

As Asthi is one of seven Dhatus, it should be present in entire body. It may be present in large quantity in some places and may be functioning specifically in context to some organs. Such places are the locations of Asthi Dhatu.

Location of Asthi Dhatu is in its strotas as well as in all body organs directed in Asthisara individual.

अस्थिवहानां स्त्रोतसां मेदोमुलं जघनं च ।

च. वि. ५/७.

Moolasthanas of Asthivaha strotas are principle organs like Meda Dhatu and jaghana (groin region/ pelvic bone).

अस्थि-अपि द्रवरूपम् अस्ति-एव स्त्रोतोवाह्यम्-इति कृत्वा अस्थिवहानाम् इति-उक्तम् ।

चक्रदत्त टीका च.वि. ५/७.

Chakrapani explains that Asthi Dhatu is found in fluid form and it is transported to Asthivaha strotas for nourishment of Asthi dhatu.

Strotas is such space in living body, where absorption of nutrients required for the entity takes place. Meda is formed before Asthi Dhatu and at that time Asthi poshakansh formed, which is absorbed in Asthivaha strotas for development of Asthi Dhatu. So nutrition of Asthi Dhatu depends on proper nourishment of Meda Dhatu.

Jaghana is mentioned as root organ of Asthivaha strotas. Any problem with jaghana or pelvic region leads to disturbance in upright position of living body. Pelvic region contains 'Pakwashaya' which gives origin to Vata. It contains purisha (feces). Interrelation between Asthi, Vata and purisha is directly read here as -

या एव कला पुरीषधरा सा एव अस्थिधरा ।

सु. क. ४/४० डल्हण

Purisha-dhara kala is the 5th kala which exist in large intestine that is in pakwashaya. Function of purisha-dhara kala is to separate constituents of kitta or waste products in colon. Vayu is produced in pakwashaya as anna-mala. Asrayashray bhava of Asthi Dhatu and Vata Dosha is described. So pakwashaya and Asthi, both

are main seats of Vata Dosha. Therefore increased or decreased formation of Vata and purisha affects all sites of Vata, especially Asthi Dhatu. Hence jaghana is also a root of Asthivaha strotas.

Sushruta Samhita did not mention Asthivaha strotas.

Asthi Dhatu karya (Functions):-

धारणम् (अस्थनः श्रेष्ठं कर्म) । अ.ह.सू. ११/४

अस्थिनि देहधारणं मज्जः पुष्टिं च । सु. सू. १५/३.

Function of Asthi Dhatu is to hold the living body. It also nourishes next Dhatu namely Majja Dhatu because Majja poshakansh is formed during the formation of Asthi Dhatu.

अभ्यन्तरगतैः सारैः यथा तिष्ठन्ति भूरुहाः ।

अस्थिसारैः-तथा देहा ध्रियन्ते देहिनां ध्रुवम् ॥

तस्मात्-चिरविनष्टेषु त्वङ्मांसेषु ारीणिनाम् ।

अस्थीनि न विन यन्ति साराणि-एतानि देहिनाम् ॥

मांसानि-अत्र निबद्धानि सिराभिः स्नायुभिः-तथा ।

अस्थीनि-आलंबनं कृत्वा न् गिर्यन्ते पतन्ति वा ॥

सु. ण. ५/२१, २२, २३.

As inner part called 'sara' of tree holds it upright, human stays upright due to Asthi Dhatu. When body deteriorates, skin, soft tissue gets destroyed but Asthi never get destroyed, since they are 'sara' portion. Asthi get tightly bound by Mamsa Dhatu and with the help of 'sira' and 'snayu'. They keep body upright without deteriorating or falling off.

Upadhatu of Asthi Dhatu:-

दन्ताः। आ. पू. खंड ५/१७.

In Sharangdhar Samhita danta (teeth) is mentioned as Upadhatu of Asthi. Charka has not mentioned the Upadhatu of Asthi.

तथा-अष्टमे मासि सर्वगुणसंपन्ना भवन्ति ।

का.सं. सू. २०/७.

Danta utpatti - In eighth month eruption of teeth are with best quality that is 'Dantsampat'.

Mala of Asthi Dhatu:-

नख.....। आ. पू. खंड ५/१४.

According to Sharangdhar nakha (nails) are mala of Asthi dhatu.

नख रोम च ।

सु.सू. ४६/५२७

के ।-लोम-नख-अस्थिनिः मलः ।

च.चि. १५/३०

Charaka and Sushruta Samhita state kesha (hair), nakha (nails) and loma (body hairs) are mala of Asthi Dhatu.

Growth of kesha (hairs) and nakha (nails):-

त्रिः पक्षस्य के । मश्रु-लोम-नखान् संहारयेत्,

च. सू. ८/१८.

According to Charaka samhita shaving, haircutting and nail cutting are to be done thrice in fortnight (fifteen days). This is when the word 'paksa' is interpreted as a fortnight. But according to acharya Ksharpani, the word 'paksa' may as well mean one month. In that case all this is to be done thrice a month, that is a once in every ten days.

Asthivrudhi Lakshana:-

अस्थि (अति वृद्धं) अधि-अस्थिनि-अधिदन्ताः च ।

सु.सू. १५/१८.

Extra bones like cervical spine or calcaneal spur (adhyasthi), over crowding of teeth are (adhidanta) the symptoms of Asthi vridhhi.

चकारात् के ा-नखयोः-अतिवृद्धिः-ज्ञेया ।

डल्हण

According to Dalhana Asthi vridhhi also leads to excess growth of nails and hairs.

अस्थि-अधिस्थि-अधिदन्ताः च ।

अ.ह.सू. ११/११.

Asthi (bone tissue) when increased causes over growth of bones and extra teeth.

Asthikshaya Lakshana:-

के ालोमनख मश्रुद्विजप्रपतनं श्रमः ।

ज्ञेयम्-अस्थिक्षये लिङ्गं सन्धि रौधिल्यम्-एव च ॥

च. सू. १७/६७

Due to waning Asthidhatu falling of head and body hair, nail, beard and teeth is observed. Along with these manifestations looseness in joints is precipitated.

अस्थिक्षये अस्थि लूलं दन्तनखभङ्गे रौक्ष्यं च ।

सु. सू. १५/१३

Sushruta described features of waning of Asthidhatu as, sever pain in bones, brittleness of teeth and nails along with dryness.

रौक्ष्यं देहस्य दन्तनखानां च ।

डल्हण

Dalhana adds that entire body becomes dry along with nails and teeth.

अस्थिनि- अस्थितोदः ादनं दन्त-के ा-नखादिषु ।

अ.ह.सू. ११/१९

Decrease of Asthi causes pain in the joints, falling off of the teeth, hairs, nails etc (prematurely).

Asthipradoshaj Vyadhi:-

अधि-अस्थि-दन्तौ दन्त-अस्थिभेद लूलं विवर्णता ।

के ।-लोम-नख- मश्रु-दोषाःच-अस्थिप्रदोषजाः ॥

च.सू. २८/१६.

Following disease are caused by the vitiation of Asthi (bone tissue) :- hypertrophy of the bones and teeth, cracking sensation in the teeth and pain in bone, discoloration and morbidity in hair of the head, small hair of the body, nail as well as beard.

अधि-अस्थि-अधिदन्त-अस्थितोद- लूल-कुनखप्रभृतयोः अस्थिदोषजाः ।

सु.सू.२४/८.

Extra bony growth, extra tooth, pricking and other types of pain in bone, kunakha (a disease of nails) etc. are caused by vitiation of asthi (bone).

- **Asthi and sandhi in Ayurveda –**

1) Parshni (heel) -

पश्चिमदेगे-अवस्थितो गुल्फ-अधो मांसलो भागः।

च.वि.८/१०७.

पञ्चचतुर-अङ्गुल-आयत-विस्तृता पार्श्वी ।

सु. पा.५/१९.

In Sushrut samhita parshni is described as five fingers long and four fingers broad.

2) Gulpha (ankle joint) –

ग्रीवपादजंघायोः मध्ये स्थितः संधिभागः ।

च.वि.८/१०७

चतुर्दश-अङ्गुल परिणाह गुल्फः ।

सु.सू.३५/१२

Circumference of the middle portion of ankle is fourteen fingers, measured in samhitas.

3) Janu (knee) –

जानु जंघा-उरु संधिः।

च.वि. ८/११७.

जानुनी चतुर्-अङ्गुले षोडश- अङ्गुल परिणाहौ ।

च.वि.८/११७.

According to Charaka samhita length and circumference of knee joint are four and sixteen fingers respectively. While in

Sushruta samhita circumference of the middle portion of knee joint is fourteen fingers.

4) Aratni –

निष्कनिष्ठेन मुष्टिना हस्तेन यत् परिणामं तत् विंति-अङ्गुलहस्तः ।

आ.को.सं.७.

विस्तृतकनिष्ठिका-अङ्गुलि- मुष्टिक हस्तः चतुर्विंति-अङ्गुलहस्तः ।

सु. चि.३०/१०, सु. ॥.८/८

The distance between the elbow to the tip of the little finger is considered as aratni.

5) Jatru (clavicle) –

स्कन्ध-कक्षा-सन्धि-अस्थि ।

च. ॥.७/६.

ग्रीवामूलम् सु.सू.४६/४४०.

It is the continuations of the vertebrae, collar-bones and cartilages of the breast-bone.

6) Chibuka (chin) –

हनु-अग्रभागः ।

चक्रपाणी च. ॥.७/११.

प्रमाणः-तत्-चतुर्-अङ्गुलम् ।

च.वि.८/११७.

ओष्ठ-अधो-मांस-अस्थिपिण्डिका । तद् द्व्यङ्गुल प्रमाणम् ।

डल्हण सु. सू.३५/१२.

The tip of hanu-asthi is mentioned as chibuka in Chakrapani commentator. It is measures four fingers in Charka samhita, while two fingers in Sushruta samhita.

7) Shira (head) –

षोडश-अङ्गुल-उत्सेधं द्वात्रिंशत्-अङ्गुल परिणाहं िरः ।

च.वि.८/११७.

The circumference of head is measured as thirty two fingers.

8) Parv –

अवयव-संधिः ।

च. ॥.७/१४, सु.सू. २५/३८.

Parv is mentioned as avayav sandhi (joint).

द्वादश-अङ्गुलानिमणिबंध स्थौल्यानिः ।

सु.सू.३५/१२

The circumference of manibandh sandhi is twelve fingers.

9) Asthi (jangha)–

जंति तु-अष्टादश-अङ्गुले षोडश- अङ्गुल परिक्षेपे ।

च.वि.८/१०७.

अष्टादश-अङ्गुले जंति ।

सु.सू.३५/१२.

The length of Jangha is measured as eighteen fingers where as circumference is sixteen fingers.

10) Danta (teeth) –

द्वय-अङ्गुलानि दन्तम् ।

सु.सू.३५/१२.

The measurement of danta is mentioned as two fingers in Sushruta Samhita.

11) Skandha (shoulder) –

बाहुपरिः बाहः-उपरितनो भागः ।

च.वि.८/१०७. सु.सू.४६/१३१.

Proximal and upper part of arm is known as Skandh.

B. Modern review of Bone -

- **Osseous tissue or bone -**

Bone or osseous tissue is essentially a highly vascular, living, constantly changing mineralized connective tissue. It is remarkable for its hardness, resilience and regenerative capacity, as well as its characteristic growth mechanisms. It is a specialized rigid connective tissue that forms the skeleton. It consists of special type of cells and tough intercellular matrix of ground substance. The matrix is formed by organic substances like collagen and it is strengthened by the deposition of mineral salts like calcium phosphate and calcium carbonate. Throughout life, the bone is renewed by the process of bone formation and bone resorption.

- **Classification of bone –**

- a) Based on the development -**

- 1) Membranous bones:**

These are also known as dermal bones and the process by which they ossify is called intra-membranous ossification. These bones ossify from mesenchymal condensations in the intrauterine life. Examples are bones of the skull and facial bones.

- 2) Cartilagenous bones:**

These bones ossify from a cartilage model and this type of ossification is known as intra-cartilaginous ossification. These bones do not form from mesenchymal condensations but from preformed cartilage models. Examples of this type of bones include bones of limbs, vertebral column and thoracic cage.

- 3) Membrano-cartilagenous bones:**

These bones ossify partly from cartilage and partly from mesenchymal condensations. Examples of this class of bones include clavicle, mandible, occipital, temporal and sphenoid etc.

- b) Based on the shape & size –**

- 1) Long bones:**

"Long bones" have greater length than width and consist of a shaft and a variable number of endings (extremities).

They are usually somewhat curved for strength.

Examples include femur, tibia, fibula, humerus, ulna and radius.

2) Short bones:

"Short bones" are roughly cube-shaped and have approximately equal length and width.

Examples include carpal and tarsal bones.

3) Flat bones:

"Flat bones" have a thin shape/structure and provide considerable mechanical protection and extensive surfaces for muscle attachments.

Examples include cranial bones (protecting the brain), the sternum and ribs (protecting the organs in the thorax), and the scapulae (shoulder blades).

4) Irregular bones:

"Irregular bones" have complicated shapes and so cannot be classified into any of the above (shape-based) categories. Their shapes are due to the functions they fulfill within the body e.g. providing major mechanical support for the body yet also protecting the spinal cord (in the case of the vertebrae).

Examples include the vertebrae and some facial bones.

5) Sesamoid bones:

"Sesamoid bones" develop in some tendons in locations where there is considerable friction, tension, and physical stress. They

may therefore form in the palms of the hands and the soles of the feet, however their presence and quantity varies considerably from person to person.

Examples common to everyone include the patellae (kneecaps).

6) Sutural bones:

"Sutural bones" are classified by their location rather than by their shape. They are very small bones located within the sutural joints between the cranial bones. The number of sutural bones varies considerably from person to person, therefore these are unnamed bones.

c) Based on macroscopic structure –

1) Compact bones :

The shaft or body of all long bones is compact bone. Example is long bones.

2) Spongy or cancellous bones :

They have a thin outer shell of compact substances and a network of lamellae of bone or bony trabeculae within. Example – flat, short irregular bones and the ends of long bones.

3) Diploic bones :

Most of cranial bones are diploic types and consist of an inner and outer compact layer called as inner and outer tables respectively and an intervening porous layer.

The irregular spaces in the porous layer are occupied by a spongy substance, which consists of diploic veins and marrow substances.

d) Based on microscopic structure –

1) Lamellated bone :

All spongy or cancellous bones and new bones in making are lamellating bones microscopically.

2) Haversian bone :

All compact bone, as for example the bodies of long bone.

3) Fibrous bone :

This is variety of immature bone where the surface of the bone is characterised by a dense network of fibrous bundles. The diaphysis of a growing bone is a variety of fibrous bone.

4) Dentine :

The portion of a tooth that intervenes between the enamel and the cement externally and the pulp cavity internally is called as dentine.

5) Cement :

The cement lines the dentine at the root and intervenes between the dental periosteum and the dentine.

• **Parts of bone: -**

1) Diaphysis – (growing between)-

It is bone's shaft or body – the long cylindrical, main portion of bone.

2) Epiphyses – (growing over)-

Epiphyses are distal and proximal ends of bone.

3) Metaphyses -

Metaphyses are regions in mature bone where the diaphysis joins the epiphyses. In growing bone, each metaphysis includes an epiphyseal plate, a layer of hyaline cartilage that allows the diaphysis of the bone to grow in length.

4) Articular cartilage -

Articular cartilage is thin layer of hyaline cartilage covering the part of epiphysis where the bone forms an articulation (joint) with another bone. It reduces friction and absorbs shocks at freely movable joints.

5) Periosteum -

Periosteum is tough sheath of dense irregular connective tissue that surrounds the bone surface wherever it is not covering by articular cartilage.

6) Medullary cavity -

It is the space within the diaphysis that contains fatty yellow bone marrow in adults.

7) Endosteum -

It is thin membrane that lines the medullary cavity. It contains a single layer of bone-forming cells and a small amount of connective tissue.

- **Composition of bone:-**

Bone is made up of-

- a) Extracellular matrix
- b) Bone cells.

a. Extracellular matrix :-

- i) Water – 25%
- ii) Organic matrix – formed by collagen fibers – 25%
- iii) Inorganic matrix – formed by crystalline mineral salts – 50%
contains = mineral salts – calcium phosphate, calcium carbonate, calcium hydroxide and ions – magnesium, fluoride, potassium, sulfate.

The bone's hardness depends on the crystallized inorganic mineral salts, a bone's flexibility depends its collagen fibers.

b. Bone cells :-

- i) Osteogenic cells (genic-producing)
- ii) Osteoblasts (blasts-buds/sprouts)
- iii) Osteocytes (cytes-cells)
- iv) Osteoclast (clast-break)

i) Osteogenic cells (genic-producing):-

These are unspecialized stem cells derived from mesenchyme, the tissue from which all connective tissues are formed. They are the only bone cells to undergo cell division and develop into osteoblasts. These cells are found along inner portion of the periosteum, in endosteum and in the canals within bone that contain blood vessels.

ii) Osteoblasts (blasts-buds/spouts):-

These are the bone cells that are concerned with bone formation. These are situated in the outer surface of bone, the marrow cavity and epiphyseal plate. The osteoblasts arise from the giant multinucleated primitive cells called the osteoprogenitor cells. The differentiation of osteoprogenitor cells into osteoblasts is accelerated by some hormones and some bone proteins called skeletal growth factors. The growth factors stimulate the growth of osteoblasts also. Osteoblasts are rich in alkaline phosphatase, glycolytic enzymes and phosphorylases.

Function – These cells play important role in the formation of bone matrix, calcification and synthesis of protein.

iii) Osteocytes (cytes-cells):-

These are mature bone cells. These are main cells of developed bone and are derived from the matured osteoblasts. Osteocytes are the cells concerned with maintenance of bone. Osteocytes are small flattened and rounded cells embedded in the bone lacunae. The cytoplasmic processes from osteocytes run into canaliculi and ramify throughout the bone matrix. The processes from neighboring osteocytes have contact with each other forming tight junctions.

Functions – 1) Help to maintain the bone as living tissue because of their metabolic activity.

2) Maintain the exchange of calcium between the bone and extracellular fluid.

iv) Osteoclasts (clast-break):-

These are huge cells derived from the fusion of as many as monocytes and are concentrated in endosteum. Osteoclasts are the bone cells that are concerned with breakdown of bone extracellular matrix, termed resorption. Osteoclasts are the giant phagocytic multinucleated cells found in the lacunae of bone matrix.

Function – 1) Responsible for bone resorption during bone remodeling.

2) Synthesis and release of lysosomal enzymes necessary for bone resorption into the bone resorbing compartment.

- **Structure of bone:-**

The bone is covered by an outer white fibrous connective layer called periosteum and an inner dense fibrous membrane called endosteum.

The bones have two layers of structures –

- 1) Outer compact bone
- 2) Inner spongy bone.

In most of the bones, both compact and spongy forms are present. However, the thickness of each type varies in different regions. The epiphysis contains large amount of spongy bone and outer thin compact bone. In diaphysis, the amount of compact bone is more and the spongy bone is very thin.

1) Compact bone -

The basic unit of compact bone is an osteon or Haversian system.

Each osteon has 4 parts -

i) Lamellae – (little plates)

Lamellae are concentric rings of extracellular matrix that consist of mineral salts (mostly calcium and phosphates) which give bone its hardness and collagen fibers which give bone its strength. The lamellae are responsible for compact nature of this type of bone tissue.

ii) Lacunae -

These are small spaces between lamellae that contain mature bone cells called osteocytes.

iii) Canaliculi -

Projecting from the lacunae are canaliculi (little canals) networks of minute canals containing the process of osteocytes. It provides routes for nutrients to reach osteocytes and for wastes to leave them.

iv) Central (haversian) canal -

Contain blood vessels and nerves.

2) Spongy bone -

In spongy bone, lacks osteons. Rather, it consists of columns of bone called trabeculae (little beams) , which contain lamella, osteocytes , lacunae and canaliculi . The spaces between lamellae filled with red bone marrow.

A bone is made up of several different tissues working together – bone or osseous tissue, cartilage dense connective

tissue, epithelium, adipose tissue and nervous tissue. For this reason, each individual bone in body is considered an organ. The entire framework of bones and their cartilages constitutes the skeletal system.

- **Bone formation (ossification of bone) and bone growth -**

The process by which bone forms is called ossification (ossi-bone, fication-making) or osteogenesis. The 'skeleton' of a human embryo is composed of loose mesenchymal cells, which are shaped like bones and are the sites where ossification occurs. Development of bone begins during the sixth week of embryonic development. There are **two methods** of ossification.

- 1) Intramembranous ossification
- 2) Endochondral ossification

- 1) Intramembranous ossification –**

It is the simpler method of bone formation. The flat bones of the skull and mandible are formed in this way. Also, the "soft spots" that help the fetal skull pass through the birth canal later harden as they undergo intramembranous ossification, which occurs as –

- i) Development of the ossification center –

At the site where the bone will develop, specific chemical messages cause the mesenchymal cells to cluster together and differentiate, first into osteogenic cells and then into osteoblasts. The site of such a cluster is called an ossification center. Osteoblasts

secrete the organic extracellular matrix of bone until they are surrounded by it.

ii) Calcification –

Next, the secretion of extracellular matrix stops and the cells, now called osteocytes, lie in lacunae and extend their processes into canaliculi that radiate in all directions. Within a few days, calcium and other mineral salts are deposited and the extracellular matrix hardens or calcifies.

iii) Formation of trabeculae –

As bone extracellular matrix forms, it develops into trabeculae that fuse with one another to form spongy bone. Blood vessels grow into the spaces between the trabeculae differentiates into red bone marrow.

iv) Development of the periosteum –

As the periphery of the bone, the mesenchyme condenses and develops into the periosteum. Eventually, a thin layer of compact bone replaces the surface layers of the spongy bone, but spongy bone remains in the center. Much of the newly formed bone is remodeled (destroyed and reformed) as the bone is transformed into its adult size and shape.

2) Endochondral ossification –

Bone forms within hyaline cartilage that develops from mesenchyme. Although most bones of the body are formed in this way, the process is best observed in a long bone as –

i) Development of cartilage model –

At the site where the bone is going to form, specific chemical messages causes the mesenchymal cells to crowd together in the shape of the future bone and then develop into chondroblasts. The chondroblasts secrete cartilage model consisting

of hyaline cartilage. A membrane perichondrium develops around the cartilage model.

ii) Growth of the cartilage model –

Once chondroblasts become deeply buried in the cartilage extracellular matrix, they are called chondrocytes. The cartilage model grows in length by continual cell division of chondrocytes and secretion of cartilage extracellular matrix, this growth is termed interstitial growth. In contrast, growth of cartilage thickness is due to mainly addition of more extracellular matrix material to periphery of model by new chondroblasts that develop from perichondrium this type of growth is called appositional growth.

iii) Development of primary ossification center –

Primary ossification proceeds inward from the external surface of the bone. A nutrient artery penetrates the perichondrium and the calcifying cartilage model through a nutrient foramen in the mid-region of the cartilage model, stimulating osteogenic cells in the perichondrium to differentiate into osteoblasts. Near the middle of model, periosteal capillaries grow into the disintegrating calcified cartilage, inducing growth of a primary ossification center, a region where bone tissue will replace most of the cartilage. Osteoblasts then begin to deposit bone extracellular matrix over the remnants of calcified cartilage, forming spongy bone trabeculae.

iv) Development of medullary (marrow) cavity –

As the primary ossification center grows toward the ends of the bone, osteoclasts break down some of the newly formed spongy bone trabeculae. This activity leaves a cavity, the medullary cavity in diaphysis (shaft). Eventually, most of the wall of the diaphysis is replaced by compact bone.

v) Development of secondary ossification center –

When branches of epiphyseal artery enter the epiphyses, secondary ossification centers develop, usually around the time of

birth. Bone formation is similar to that in primary ossification centers. In contrast to primary ossification, secondary ossification proceeds outwards from the center of the epiphysis towards the outer surface of the bone.

vi) Formation of articular cartilage and the epiphyseal plate –

The hyaline cartilage that covers the epiphyses becomes the articular cartilage. Prior to adulthood, hyaline cartilage remains between the diaphysis and epiphysis as the epiphyseal plate, which is responsible for the length wise growth of long bones.

At the time of birth, the skeleton consists of 50% cartilage and 50% bone. At the age of two and thereafter, the skeleton have 35% cartilage and 65% bone.

• **Calcification (Mineralization) –**

Calcification is the process in which calcium salts build up in soft tissue causing it to harden.

The Mineralization is start about 10-12 days after formation of osteoid. In the extracellular matrix, the most abundant mineral salt is calcium phosphate $[\text{Ca}_3 (\text{PO}_4)_2]$. It combines with another mineral salt, calcium hydroxide $[\text{Ca} (\text{OH})_2]$ to form crystals of hydroxyapatite. As the crystals form, they combine with still other mineral salts, such as calcium carbonate (CaCO_3) and ions such as magnesium, fluoride, potassium and sulphate. As these mineral salts are deposited in the framework formed by the collagen fibers of the extracellular matrix, they crystallize and the tissue hardens. This process of calcification is initiated by bone-building cells called osteoblasts by secreting enzyme alkaline phosphate.

It was once thought that calcification simply occurred when enough mineral salts were present to form crystals. The process requires the presence of collagen fibers. Mineral salts first begin to crystallize in the microscopic spaces are filled, mineral crystals accumulate around the collagen fibers. Although bone's hardness depends on the crystallized inorganic mineral salts and flexibility depends on its collagen fibers.

• **Bone remodeling –**

Like skin, bone forms before birth but continually renews itself thereafter. Bone remodeling is the ongoing replacement of old bone tissue by new bone tissue. It involves –

- i) Bone resorption
- ii) Bone deposition

i) Bone resorption –

Bone resorption means the removal of mineral and collagen fibers from bone by osteoclasts.

ii) Bone deposition –

Bone deposition means the addition of minerals and collagen fibers to bone by osteoblast.

Thus, bone resorption results in the destruction of bone extracellular matrix, while bone deposition results in the formation of bone extracellular matrix.

At any given time, about 5% of the total bone mass in the body is remodeled. The renewal rate for compact bone tissue is about 4% per year and for spongy bone tissue it is about 20% per year. Remodeling also takes place at different rates in different regions of body. Remodeling also removes injured bone, replacing it with new bone tissue. It may be triggered by factors such as exercise, sedentary lifestyle and changes in diet.

Since the strength of bone is related to the degree to which it is stressed, if newly formed bone is subjected to heavy loads, it will grow thicker and therefore be stronger than the old bone. Also the shape of a bone can be altered for proper support based on the stress patterns experienced during the remodeling process. Finally new bone is more resistant to fracture than old bone.

• Factors affecting bone growth and bone remodeling –

Normal bone metabolism – growth in the young and bone remodeling in adult depends on several factors. These include adequate dietary intake of minerals and vitamins as well as sufficient levels of several hormones.

i) Minerals -

Large amounts of calcium and phosphorus are needed while bones are growing, as are smaller amounts of fluoride, magnesium, iron and manganese. These minerals are also necessary during bone remodeling.

ii) Vitamins –

Vitamin C is needed for synthesis of collagen, the main bone protein and also for differentiation of osteoblasts into osteocytes. Vitamin K and vitamin B₁₂ also are needed for protein synthesis; where as vitamin A stimulates activity of osteoblasts.

Vitamin D (calciferol D₃) is necessary for the calcification process. Vitamin D might stimulate osteoblastic bone formation and mineralization. The rate of active transport of calcium across the intestinal wall is increased by vitamin D. It promotes the absorption of phosphate if there is increased absorption of calcium. Vitamin D maintains normal structure of bone and assists to govern the equilibrium between bone calcium and blood calcium.

iii) Hormones –

- Insulinlike growth factors (IGFs) –

It is produced by the liver and bone tissue. IGFs stimulate osteoblasts, promote cell division at the epiphyseal plate and in the periosteum and enhance synthesis of the proteins needed to build new bone. IGFs are produced in response to the secretion of human growth hormone (hGH) from the anterior lobe of the pituitary gland.

- Thyroid hormones –

T₃ and T₄ from the thyroid gland also promote bone growth by stimulating osteoblasts.

Calcitonin inhibits the activity of osteoclasts.

- Sex hormones –

Sex hormones cause a dramatic effect on bone growth. Sex hormones include estrogens and androgens such as testosterone. The adrenal glands of both sexes produce androgens and other tissues, such as adipose tissue, can convert androgens to estrogen. These hormones are responsible for increased osteoblast activity and synthesis of bone extracellular matrix and the sudden 'growth spurt' that occurs during the teenage years.

Estrogens in both sexes shut down growth at epiphyseal plates, causing elongation of the bones to cease.

- Parathyroid hormone –

Parathyroid hormone is the major regulator of the levels of calcium (Ca²⁺), magnesium (Mg²⁺) and phosphate (Hpo₄²⁻) ions in the blood. The specific action of PTH is to increase the number and activity of osteoclasts. The result is elevated bone resorption, which releases ionic calcium and phosphates (Hpo₄²⁻) into the blood.

PTH also acts on the kidneys – As decrease lost of Ca^{2+} and Mg^{2+} from blood into urine and increase loss of Hpo_4^{2-} from blood into urine. Because of that Ca^{2+} and Mg^{2+} levels increased in blood while decreases blood Hpo_4^{2-} level.

Again PTH effect on the kidneys is to promote formation of the hormone Calcitriol, the active form of vitamin D, which increases the rate of Ca^{2+} , Hpo_4^{2-} and Mg^{2+} absorption from the gastrointestinal tract into blood.

• Functions of Bone –

1) Support -

Skeleton serves as structural framework for body by supporting soft tissues and providing attachment points for the tendons of most skeletal muscles.

2) Protection -

Protect most important internal organs from injury. For example cranial bone protects the brain, vertebrae protect the spinal cord and rib cage protects the lungs and heart.

3) Assistance in movement -

Most skeletal muscles attach to bones; when they contract, they pull on bones to produce movement.

4) Mineral homeostasis -

Bone tissue stores several minerals, especially calcium and phosphorus, which contribute to the strength of bone. On demand, bone release minerals into the blood to maintain critical mineral balance (homeostasis) and to distribute the minerals to other parts of the body.

5) Blood cell production -

Within certain bones has red bone marrow produces red blood cells, white blood cells and platelets, a process called hemopoiesis. It is present in developing bones of foetus and in some adult bones such as pelvis, ribs, vertebrae, skull and ends of bones of arm and thigh.

6) Triglyceride storage -

Yellow bone marrow consists mainly of adipose cells, which store triglycerides and its are a potential chemical energy reserve.

• Anatomical position of bones and joints –

1) Calcaneus –

On the dorsum of the foot, the anterior part of the upper surface of the calcaneus can be identified a little in front of lateral malleolus.

2) Ankle joint –

The joint is approximately uniaxial. The lower end of the tibia and its medial malleolus with the lateral malleolus of fibula and inferior transverse tibiofibular ligament, form a deep recess for the body of the talus.

3) Knee joint –

The knee joint is a hinge joint. It consists of three articulations; two condyloid joints between the condyles of the femur and the semilunar cartilage and condyles of the tibia and a third between the patella and femur.

4) Clavicle -

The clavicle is a doubly curved short bone that connects the arm (upper limb) to the body (trunk), located directly above the first rib. It acts as a strut to keep the scapula in position so the arm can hang freely. Medially, it articulates with the manubrium of the sternum (breast-bone) at the sternoclavicular joint. At its lateral end it articulates with the acromion of the scapula (shoulder blade) at the acromioclavicular joint. It has a rounded medial end and a flattened lateral end.

5) Mandible-

The mandible, the largest and strongest bone of the face, serves for the reception of the lower teeth. It consists of a curved, horizontal portion, the body, and two perpendicular portions, the rami, which unite with the ends of the body nearly at right angles.

6) Wrist joint –

The joint line obtained by joining the styloid processes of radius and ulna is convex upwards.

7) Tibia –

Tibia is the medial and larger bone of the leg. It lies vertically in the body.

8) Shoulder joint –

The anterior margin of the glenoid cavity corresponds to the lower half of the shoulder joint. It is marked by a line 3 cm long drawn downwards from a joint just lateral to the tip of the coracoid processes. The line is slightly concave laterally.

◆ **Bone mass**

- ❖ Bone mass means mineral content of bone.

(www.answers.com/topic/bonemass.)

- ❖ Definition Bone mass – NIC dictionary of cancer.

A measurement of the amount of minerals (mostly calcium and phosphorous) contained in certain volume of bone.

A measurements are used to diagnose osteoporosis (decreased bone mass) to see how well osteoporosis treatment are working and to predict how likely the bones are to break. Bone mass also called BMD, bone density.

(<http://www.medicinement>.)

- ❖ Bone mass refers to the amount of minerals (mostly calcium and phosphorous) that a specific volume of bone contains. Bone mass is also mineral density (BMD). A person with low bone density is at high risk for fractures and osteoporosis.

- ❖ Bone mass is a measure of the amount of minerals that bone contains.

(http://www.ehow.com/facts-5542767_bone-mass.html.)

- ❖ This feature indicates the amount of bone mineral level (calcium and other minerals) in the body.

- **Normal values of Bone- mass -**

Women: Average of estimated bone mass (kg)

Body Weight

below 50 kg	50 kg – 75 kg	75 kg & above
1.95 kg	2.40 kg	2.95 kg

Men: Average of estimated bone mass (kg)

Body Weight

below 65 kg	65 kg – 95 kg	95 kg & above
2.66 kg	3.29 kg	3.69 kg

◆ **Inner Scan Body Composition Monitor**

Indication:-

- It is intended for adults 18 to 99 years.
- Children aged 7 to 17 years can use the monitor for weight and body fat percentage readings only; the other features are not applicable to children.
- Pregnant women, dialysis patients and people with edema are advised to regard the percentage of body composition readings as a reference for monitoring changes in readings.

Safety precautions: -

People with an electronic medical implant, such as a pace maker, should not use a Body Composition Monitor as it passes a low level electrical signal through the body, which may interfere with its operation.

How does it work? : -

- i) Tanita Body Composition Monitor calculates your body composition using unique Advanced Dual – Frequency Technology. This technology is superior to basic BIA technology and will provide you with highly accurate readings.
- ii) Safe, low level electrical signals are passed through the body via the patented Tanita footpads on the monitor platform. It is easy for the signal to flow through fluids in the muscle and other body tissues.

When is the best time to use it? : -

To get the most accurate reading it is important to use Body Composition Monitor at a consistent time of day under consistent conditions.



INNER SCAN BODY COMPOSITION MONITOR

C. Previous work done:

Research work already done in the subject of "Asthi - Sarata".

1. Asthi-Sara Vyaktiyon mein calcium: Ek Adhyayana- Meshram S.A (1997), Nagpur.

2. Asthi-Sara Pareekhshana mein Asthi-Sandhi ka Nishchitee- karanatmaka Mapan tatha Malon ka Prayoghshaleeya Adhyayana- Karare P.A. (1997) - Nagpur.

3. Asthi-Sara Vyaktiyon mein Rakha Rasagata Asthi- Poshakansha (serum alkaline phosphate) ki Matra: Ek Adhyayana- Gajbhiye M.B. (2000) Nagpur.

4. Asthi-Mala kesh, Nakha, Loma etc.Lakshane Vyaktechi Asthidhatu Sara-Asarattva va Nischitikarantil Upyuktata- Patil C.R. (1996) Pune.

5. Rakta, Mamsa, Asthi Dhatu Sara may Bala Pareekshana- Ek Adhyayana. – 2007-08.

4. MATERIAL AND METHODS

- Title of study – “Study of Asthi-sarata vis-à-vis Bone-mass”.
- Type of study – Open random study.
- Ethical clearance – Clearance from the institutional ethical committee was taken.
- Written consent – An informed written consent of the volunteers had been taken as the language best understood by them.

• Material :-

- The study has been performed on 50 volunteers which include 25 male and 25 female. They were randomly selected from the college and hospital campus.
- Inner scan body composition monitor – This machine had been used to determine the Bone-mass. This monitor model: Bc-532 (Tanita).

• Methods :-

a) Inclusion criteria –

- The volunteers were randomly selected from age group 25 to 45 years.
- Volunteers of both sex and having no present history of any major or minor diseases were included.

b) Exclusion criteria –

- i. Persons suffering from any acute or chronic illness.
- ii. Pregnant or breast feeding women.
- iii. Persons receiving hormone therapy.

- iv. Persons having artificial implants in their body e.g. pace maker, nails and plates etc.

c) Assessment criteria –

i) Asthi-sarata examination:-

पार्श्वि-गुल्फ-जानु-अरलि-जत्रु-चिबुक-गिराः पर्वस्थुलाः स्थूल-अस्थि-नख दन्ताः च अस्थिसाराः ।

ते महा-उत्साहाः क्रियावंतः क्लेशाः सार-स्थिर-रीरा भवन्ति-आयुष्मन्तः च ॥

च.वि.८/१०७

महागिरिः स्कन्ध दृढ-दन्त-हनु-अस्थि-नखम्-अस्थिभिः ;

सु.सू. ३५/१६.

The volunteers were randomly selected from the college and hospital campus. They had also informed about the study and mentally prepared for the same. Consent of each candidate had taken. Asthi-sarata examination of each candidate has been done.

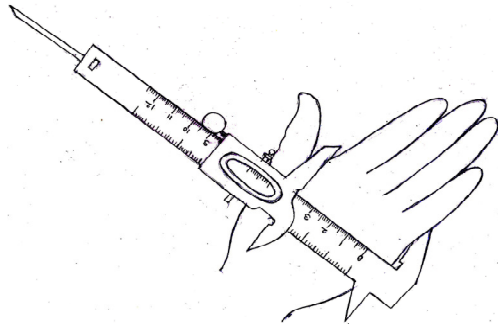
The examination of them had been carried out as per prescribed proforma. Proforma is attached in the Annexure. The proforma includes general information about the volunteers that is name, age, sex, address, religion, occupation, economical status, height, weight, Bone-mass and clinical examination of Asthi-sarata.

• **Swa-Anguli Pramana Examination –**

The distance (width) of four fingers (excluding thumb) at the proximal end (metacarpophalangeal joint) is calculated for each volunteer with the help of vernier caliper. The average width of fingers is considered as an anguli pramana of that volunteer.

The width of 4 fingers at proximal end.

Swa-anguli pramana= -----



4

Every measurement in the study that is parshni, gulpha, janu, aratni, chibuk, shira, parva, asthi etc. are measured with the help of measuring tape (tailor tape). This each reading is divided by swa-anguli praman, and then the obtained reading is considered as anguli mapan of that part.

If the measurements are as per angulipramana or more than that, it has been considered as **sthula** (broad dimension) and **drudha** (sturdy). Where as examination of 'Asthidhatu function' has been done by questioners. While health and strongness of Asthidhatu mala and upadhatu that is kesha (hairs), nakha (nails) and danta (teeth) are examined by inspection, palpation and interrogation.

- Measurement of body parts:-

- i. Parshni (calcaneus) –

The distance between postero-inferior mid-point of heel to a little in front of the lateral malleolus which is anterior part of upper surface of calcaneus, considered as parshni. The above distance is measured at lateral border of right foot.

ii. Gulpha (ankle joint) -

The circumferential distance between lateral malleolus and medial malleolus was measured with the help of measuring tape.

iii. Janu (knee joint) -

The circumferential distance is measured at the level of the tibial condyles.

iv. Aratni -

The distance from the elbow to the tip of the little finger is considered as aratni.

v. Jatru (clavicle) -

The distance between right acromion process to the right suprasternum notch is observed.

vi. Chibuka (chin bone) -

The distance between inferior border of lower lip and tip of the chin is considered as chibuka.

vii. Shira (head) -

The maximum circumference of head from the occipital protuberance to the forehead is measured as shira.

viii. Parva (e.g. wrist joint) -

Parva is considered as manibandh sandhi (wrist joint). It is measured the circumferential distance of the styloid process of ulna and radius of right wrist.

ix. Asthi (e.g. tibia) -

In this point tibia was measured. The length was measured from the medial condyle of tibia to the medial malleolus of tibia.

x. Nakha (nails) and xi. Danta (teeths) -

The broadness and strongness of these both organs were observed by inspection and interrogation.

xii. Skandha (shoulder) -

Appearance of shoulder joint is observed as skandha.

• **Scoring of observational parameters** –

Sr.no.	Body parts	Textual Anguli pramana	By examination	Score
1	Parshni	5		5 & above=1
2	Gulpha	14		14 & above=1
3	Janu	14		14 & above=1
4	Aratni	20		20 & above=1
5	Jatru	-		Sthul,drudh=1
6	Chibuka	2		2 & above=1
7	Shira	32		32 & above=1
8	Parva (manibandh sandhi)	12		12 & above=1
9	Asthi (Jangha)	18		18 & above=1
10	Skandha	-		Sthul,drudh=1

11) Can you remain physical active for whole day? (Kriyavanta).

i)Yes

ii) No

(Yes=1)

12) Can you sustain physical hardship for a longer duration without rest? (Kleshsaha).

i) Yes ii) No (Yes=1)

13) Do you remain energetic through out the day? (Mahotsaha).

i) Yes ii) No (Yes=1)

14) Do you have any history of fracture of bones after a minor trauma or accident? (Sar-sthir-sharir).

i) Yes ii) No (No=1)

15) How is the growth of nails? (Quality of mala).

i) More ii) Less (More=1)

16) How is the growth of hair? (Quality of mala).

i) More ii) Less (More=1)

17) Whether nails are thick or thin in texture? (Quality of mala).

i) Thick ii) Thin (Thick=1)

18) Whether hairs are thick or thin in texture? (Quality of mala).

i) Thick ii) Thin (Thick=1)

19) Whether the person complains of hair fall or splitting of hair? (Quality of mala).

i) Yes ii) No (No=1)

20) Whether the person complains of brittleness of nails? (Quality of mala).

i) Yes ii) No (No=1)

21) Whether dentition started at proper age?

i) Yes ii) No (Yes=1)

22) Whether the person has healthy teeth? (e.g. Without caries).

i) Yes ii) No (Yes=1)

23) Whether all joints are having a bigger dimension? (Length, breadth, circumference).

i) Yes ii) No (Yes=1)

24) Whether the person is heightened, strong and stought? (Personality).

i) Yes ii) No (Yes=1)

• **Asthi-sarata percentage:-**

Asthi-sarata	Score out of 24	Percentage
Uttam Asthi-sarata	18 & above	75% & above
Madhyam Asthi-sarata	12 to 18	50% to 75%
Heen Asthi-sarata	Below 12	Below 50%

ii) Determination of Bone-mass :-

1. Determination of Bone-mass was done with Inner scan body composition monitor.
2. The volunteer was asked to remove the ornaments, socks and clean the soles before standing on the machine.
3. The information of person was filled regarding gender, height and age.

4. After feeding data to the machine the display show "0.0" marking on it. Then the person was asked to stand on machine (in such a way that heels were correctly aligned with the electrodes on the measuring platform).
5. Different readings were obtained such as weight, body fat percentage.
6. Then by pressing number 4 Bone – mass of volunteer can be obtained.
7. Observed Bone-mass was noted.
8. Data was analyzed.

d) Statistical analysis of data :-

To determine the level of significance value of Bone-mass were compared between uttam and madhyam Asthi-sara volunteers. For this unpaired t test was applied. The level of significance was set at 5% ($P=0.05$) and considered as statistically significant. $P<0.01$ was considered as statistically very significant. Where as $P>0.05$ was considered as statistically insignificant.

To determine correlation between Asthi-sarata and Bone-mass, correlation regression was used. The correlation coefficient (r) = 0 to 1 was considered as positive correlation where as $r = 0$ to -1 was considered as negative correlation and $r = 0$ was considered as no correlation.

5. OBSERVATIONS AND RESULTS

Table no. 1 – Distribution of volunteers according to sex-

Sex	No. of volu.	%
Male	25	50
Female	25	50
Total	50	100

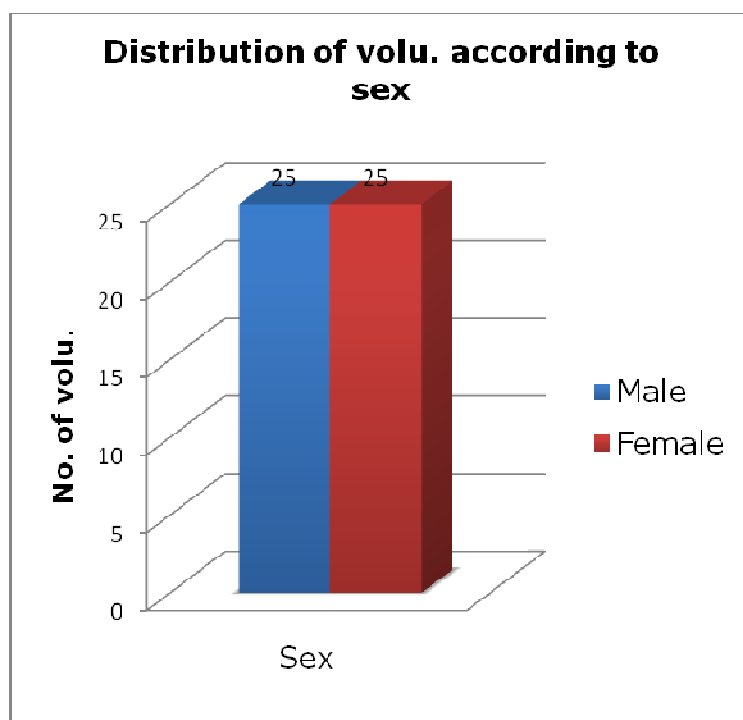


Table no. 2 – Distribution of volunteers according to Asthi-sarata.

Sarata	No. of Male volu.	No. of Female volu.
Uttam	11 (44%)	03 (12%)
Madhyam	14 (56%)	22 (88%)
Heen	00	00
Total	25 (100%)	25 (100%)

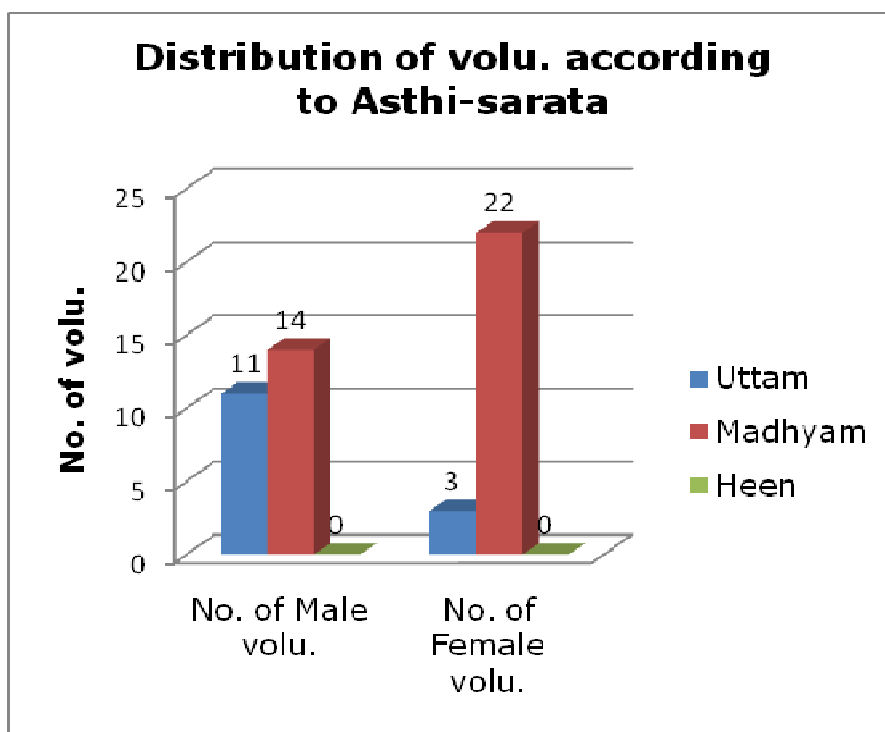


Table no. 3 – Distribution of Male volunteers according to diet & Asthi-sarata.

Diet	Uttam	Madhyam	Heen	Total
Veg.	02	06	00	08
Mix	09	08	00	17
Total	11	14	00	25

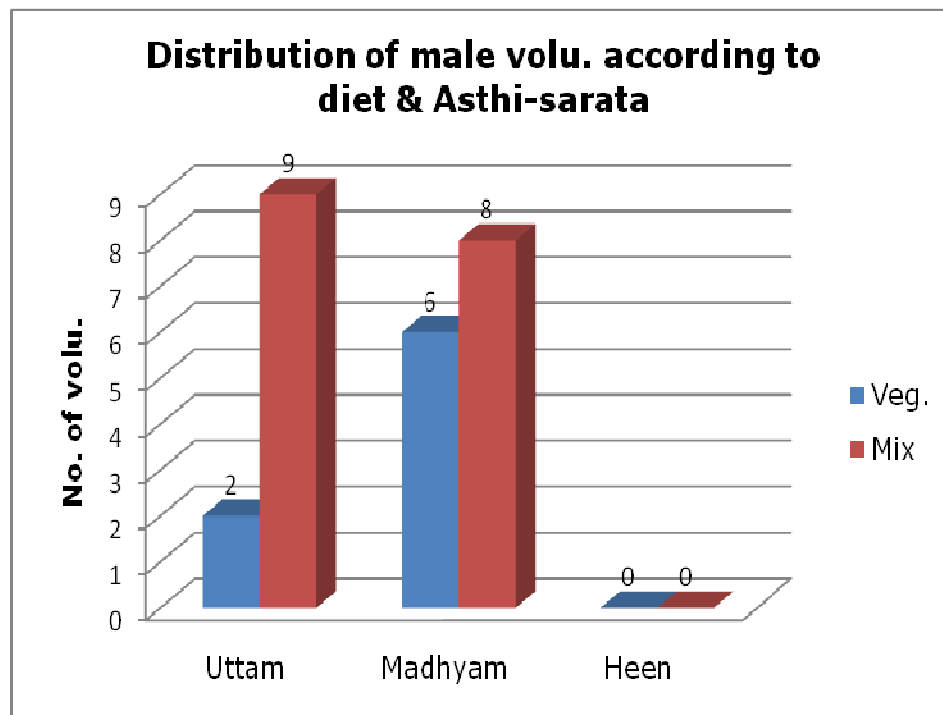


Table no. 4 – Distribution of Female volunteers according to diet & Asthi-sarata.

Diet	Uttam	Madhyam	Heen	Total
Veg.	03	02	00	05
Mix	00	20	00	20
Total	03	22	00	25

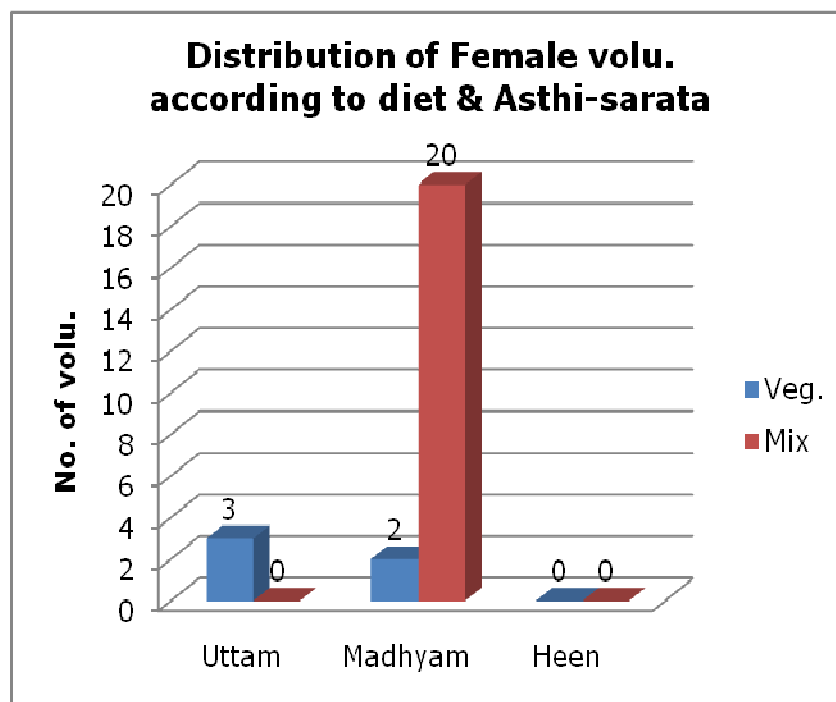


Table No. 5- Showing the comparison of Bone-mass between uttam and madhyam Asthi-sarata male volunteers:-

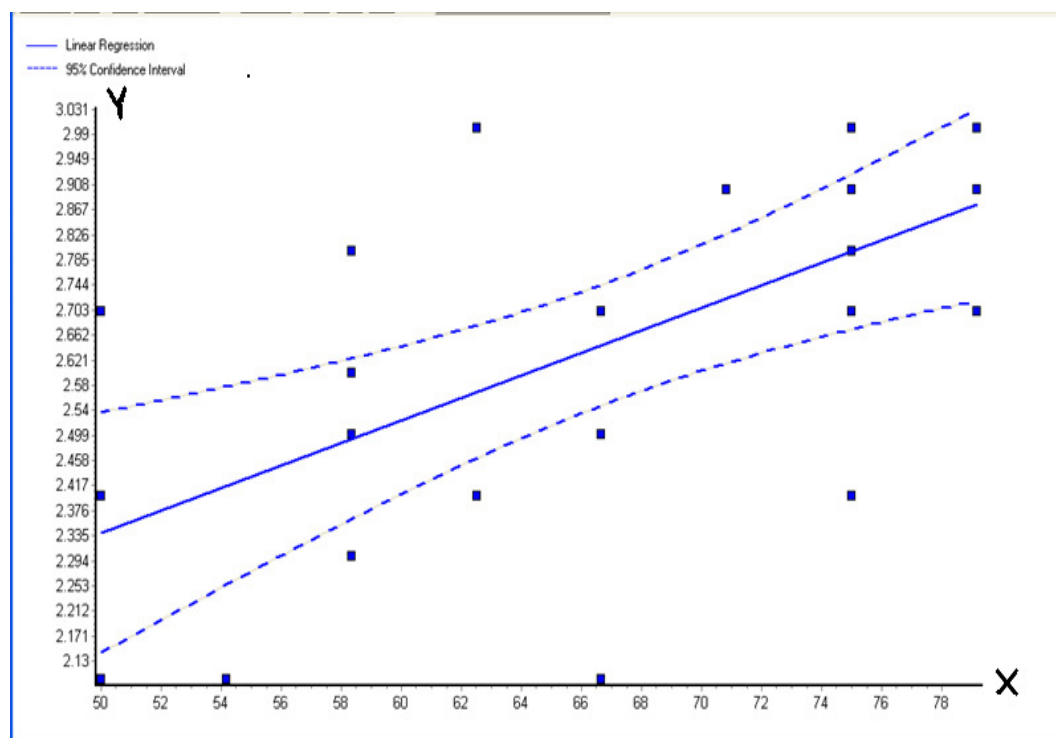
	Uttam sarata			Madhyam sarata				
	n_1	\bar{x}_1	SD_1	n_2	\bar{x}_2	SD_2	t_{23}	P
Bone-mass	11	2.83	0.18	14	2.50	0.29	3.249	<0.01

Table No. 6- Showing the comparison of Bone-mass between uttam and madhyam Asthi-sarata female volunteers:-

	Uttam sarata			Madhyam sarata				
	n_1	\bar{x}_1	SD_1	n_2	\bar{x}_2	SD_2	t_{23}	P
Bone-mass	3	2.07	0.11	22	1.99	0.15	0.81	>0.05

Table No.7 - showing Correlation between asthi-sarata & bone mass in Male volunteers.

Correlation coefficient (r) = 0.6208, considered as moderately positive.

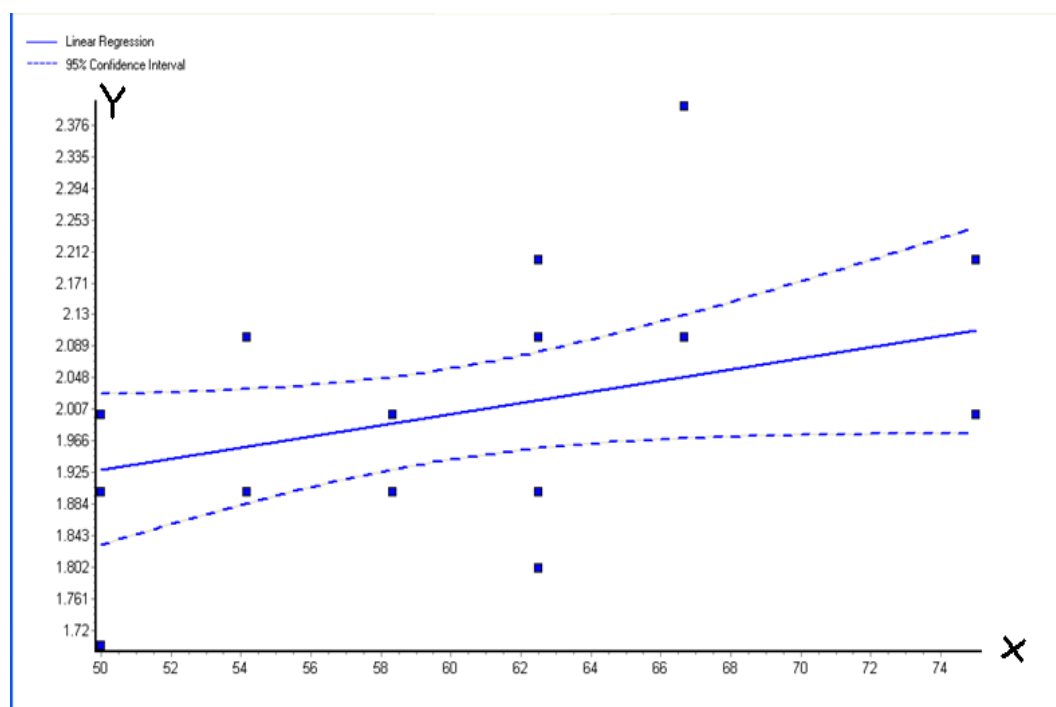


X axis= Asthi sarata percentage

Y axis= Bone mass

Table No.8 - showing Correlation between asthi-sarata & bone mass in Female volunteers.

Correlation coefficient (r) = 0.3657, considered as moderately positive.



X axis = Asthi sarata percentage

Y axis = Bone mass

6. DISCUSSION

As per intention and aim stated in Introduction, Bone-mass examination had been done for Quantitative assessment of Asthi-sarata. Correlation between Asthi-sarata and Bone-mass was also studied.

Principles of Ayurveda are mainly based on Dosha, Dhatu and Mala concept. The predominance of Doshas is described by 'Prakruti' examination and the excellency of 'Dhatus' is described by 'Sarata' examination. Sarata (tissue excellency) indicates stronger Dhatu or vishuddhatar Dhatu. Body strength (bala) is also decided by Sarata examination.

Ancient acharyas has described 'Praman parikshana' (anthropometry) also. Anthropometry as well as tissue excellency are very important to evaluate the health of a person. Certain points are mentioned to evaluate the Sarata (tissue excellency) for particular Dhatu. In Asthi-sara individuals, heel, ankle, knee, nails, teeth etc. are found sthula (broad) and drudha (sturdy).

In present study, the Bone-mass has been determined for each volunteer by "Inner Scan Body Composition Monitor". Mass means the contain matter that is the constituents in Dhatu (bone). According to modern science, Asthi (bone) is made up of organic and inorganic constituents e.g. Ca, P, Mg etc. If the constituents are present in normal range then the bone will be stronger. As per Ayurveda the person having stronger bones is labelled as Asthi-sara person.

In this study the modern quantitative parameter that is Bone-mass is used and it has been compared with Asthi-sarata. Also Bone-mass has been compared in Uttam (good), Madhyam (moderate) and Heen (poor) Asthi-sarata. Then it was seen whether uttam (good) Asthi-sara has greater bone-mass as compared to madhyam (moderate) and heen (poor).

Table no.1 – gives the idea about distribution of volunteers according to sex. For this study total 50 volunteers were randomly selected which include 25 male and 25 female.

Table no.2 – giving information about uttam (good), madhyam (moderate) and heen (poor) Asthi-sarata observed in male and female volunteers. Asthi-sarata has been observed uttam in 11 (44%) male where as madhyam in 14 (56%) male and no one has found heen. In female, Asthi-sarata has been observed uttam in 3 (12%) female where as madhyam in 22 (88%) female and no one has found heen.

In both, male and female groups no one has found heen Asthi sara. It may be because of this project has excluded the persons having the problem with bone tissue.

It is observed that, uttam (good) Asthi-sarata percentage is greater in male as compare to female. This may be because of male has naturally stronger Asthidhatu (bones). Charaka and Sushruta samhita says that, the asthi (bones), nakha (nails), kesha (hairs), danta (teeth) like hard parts are contributed by the paternal element in foetus and these are known as Pitruja Bhava (paternal factor).

Table no. 3 shows that in male volunteers who are nonvegetarian (mix) Bone tissue quality (sarata) is better. But comparison with vegetarian and nonvedetarian eaters do not show statistically significant difference. (This finding is also correlated another clinical researcher, published in American Journal of Clinical Nutrition volume 90, No. 4 , 943-950, October 2009).

Table no. 4 explains that female volunteers having moderate bone tissue quality (madhyam Asthi-sarata) have the effect of diet. Moderate bone tissue quality female volunteers are found more from nonvedetarian (mix) group.

In **table no. 5** mean Bone-mass of uttam Asthi-sara male is 2.83 and SD is ± 0.18 , where as in madhyam sarata it is 2.50 and ± 0.29 . It indicates that uttam Asthisara male has the Bone-mass more than the madhyam sara male. The Bone-mass difference observed in both the groups is statistically significant ($p < 0.01$).

It may be because of mineral percentage is greater in Asthi-sara persons as compare to other sara persons. Previous researches also indicate the greater mineral percentage in Asthi-sara persons. Also asthimala (kesh) contains more calcium percentage than other sara persons.

Table no.7- In male, as score and percentage of Asthi-sarata increases (madhyam to uttam) the Bone-mass also increases. The correlation between Asthi-sarata and Bone-mass is moderately positive ($r = 0.6208$).

Table no. 6- The mean Bone-mass of uttam Asthisara female has 2.07 and SD is ± 0.11 where as in madhyam sara it is 1.99 and SD is ± 0.15 . It indicates that Bone-mass in uttam Asthisara female is greater than madhyam Asthisara female. But the Bone-mass difference observed in both the groups is statistically not significant ($p > 0.05$).

Table no.8 -In female, as score and percentage of Asthi-sarata increases (madhyam to uttam) the Bone-mass also increases. The correlation between Asthi-sarata and Bone-mass is moderately positive ($r = 0.3637$). But the correlation between Asthi-sarata and Bone-mass in female is not quite significant as compare to male.

It may be because of the number of volunteers are very less. To increase precision, study should be done with more number of volunteers.

7. SUMMARY

The present dissertation entitled "Study of Asthi-sarata vis-à-vis Bone-mass" has been discussed in details starting from Introduction of study, Aims and objectives, Review of literature, Material and methods, Observations and results, Discussion, Conclusion, Bibliography, Annexure and summary.

1) Importance of Asthi-sarata, in Ayurvedic practice, necessity of objective parameters and intention of the present researches clarified, at the Introduction itself (chapter no. 1).

2) Chapter no. 2 – Aims and objective of the study are mentioned in this chapter.

3) Review of literature, chapter no. 3 – some basic and relevant information about sarata and Asthi dhatu are compiled from Ayurvedic literature. Anatomy and physiology of Bone, description about Bone-mass and Inner Scan Body Composition Monitor are also included.

This chapter also tells about review of previous work related to present dissertation topic.

4) Chapter no. 4 – Material and methods:- In this chapter the total plan of this research work are explained. This includes inclusion criteria, exclusion criteria, assessment criteria of Asthi-sarata examination and Bone-mass determination.

In this study total 50 healthy volunteers were randomly selected out of which 25 are male volunteers and 25 female. Asthi-sarata examination was done by swa-anguli mapan of some body parts and including regarding questioners. After that Bone-mass

was determined with the help of Inner Scan Body Composition Monitor.

5) Chapter no. 5 Observations and Results :-

Observations and results of the study are presented in the Tabular and graphical form. The distribution of the volunteers according to sex, asthi-sarata in male and female, Bone-mass according to weight in male and female, Bone-mass according to diet in male and female etc. are presented tabular as well as graphical form. Parameter for Asthi-sarata is obtained by applying unpaired t test. Where as correlation between Asthi-sarata and Bone-mass is observed positive by correlation regression.

6) Discussion Chapter no.6 includes discussion according to observations and results. It shows that Bone-mass in uttam Asthi-sara volunteers is more than madhyam Asthi-sara.

7) Chapter no. 8- Conclusion – From the experimental data and therotical thinking, suitable conclusion was drawn.

8) A list of relevant "Reference Books" is given in the chapter no. 9, Bibliography.

10) Chapter no. 10, Annexure contains abbreviation, master chart And case paper proforma.

8. CONCLUSION

- 1) It is observed that Bone-mass can be supplementary parameter to determine the Asthi-sarata.
- 2) Bone-mass indicates the number which gives the quantification to the Asthi-sarata level.
- 3) As score (percentage) of Asthi-sarata increases (madhyam to uttam) the Bone-mass also increases. The correlation between Asthi-sarata and Bone-mass is moderately positive in both, male and female volunteers.

Utility of Asthi-sarata & Bone-mass in present time:-

Ayurveda is spreading world wide very rapidly. Not only the lay people but also doctors from modern medicine are looking towards Ayurveda in a great hope. So this is high time to expose our Ayurvedic concepts in a more scientific manner with the help of some modern parameters. Then Ayurveda will be also recognize as evindence based medical fraternity.

More than this, this objective parameter is always beneficial for a clinician and research workers to access the result of their medicines or treatments.

To explain above concept let me give an example from medical practice –

When T.B. patient comes to a doctor who complains of cough, evening fever etc. allopathic physician conform diagnosis by x-ray and sputum examination then start AKT. Cough and fever goes off within a month or two, but chest physician always keep watch periodically on x-ray, sputum finding and ESR etc. to access his own treatment.

In a similar way if Ayurvedic physician find that a person has poor Asthi-sarata, by clinical judgment he can start 'Rasayana' treatment like internal medicine, Tiktakshira basti (medicated enemata) etc. Ayurvedic physician can do the Bone-mass of the patient to begin with and keep watch periodically after starting the Ayurvedic treatment, by which he will be able to prove the results of medicines with objective parameter.

Scope and limitations:-

This research project is dealing with interesting clinical examination that is Asthi-sarata. Every Ayurvedic physician needs to perform sarata (tissue excellency) examination in his practice. If he gets ideal methodology for the same, he will definitely happy. Also even a shorter method like Bone-mass determination can provide the clue for Asthi-sarata then Ayurvedic physicians will be happier.

In short ideal protocol for Asthi-sarata examination and quick indirect clue for Asthi-sarata (by Bone-mass) are the two grate contributions in the field of Ayurvedic practice. This is the real scope of utility of this research project.

Limitations:-

As this research project is conducted on a specific age group and with small number of volunteers, the observations and conclusions drawn with this data has its own limitations.

Further scope of study:-

As everybody can very well convinced by the positive results and out come of this research, it is certain that that these finding will be a boon in our medical practice. To prove the findings of this research it is better to continue the same research work with more variables like age, sex, diet and with larger sample size in further doctorate studies.

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10. ANNEXURE

a) Abbreviation :-

- च.वि. – चरक विमानस्थान
- सु.सू. – सुश्रुत सूत्रस्थान
- सु.क. – सुश्रुत कल्पस्थान
- सु. ण. – सुश्रुत णीरस्थान
- सु.उ. – सुश्रुत उत्तरतंत्र
- अ.सं. – अष्टांग संग्रह
- अ.सं. ण. – अष्टांग संग्रह णीरस्थान
- अ.ह. ण. – अष्टांग हृदय णीरस्थान
- का.सं. सू. – का यप संहिता सूत्रस्थान
- च.चि. – चरक चिकित्सा
- सु.चि. – सुश्रुत चिकित्सा
- भा.प्र. पू. – भाव प्रका । पूर्व
- ण. पू. – णीर पूर्व

• No.	- Number
• Sr.No.	- Serial number
• ID.No.	- Identity number
• Kg	- kilogram
• V.	- Vegetarian
• Mix.	- Vegetarian and non vegetarian
• A-S	- Asthi-sarata
• %	- percentage
• U	- Uttam
• MD	- Madhyam
• M	- Male
• F	- Female
• \bar{x}	- mean
• SD	- standard deviation
• r	- correlation coefficient
• n	- number of volunteers
• t	- student's t test
• P	- probability
• <	- less than
• >	- greater than
• &	- and
• Occu.	- Occupation
• Reli.	- Religion
• Eco. Stat.	- Economical Status
• Hi.	- Hindu
• Ht.	- Height
• Wt.	- Weight
• Edu.	- Education
• Med.	- Medium

**b) Master chart of "Study of Asthi-Sarata
vis-à-vis Bone - Mass".**

ID. No.	Age	sex	Reli.	Occu.	Eco. Stat.	Diet	Ht.	Wt.	A-S Score	A-S %	A-S	Bone- Mass
M-1	25	M	Hi.	Edu.	High	Mix	177	75	19	79.17	U	3
F-1	33	F	Hi.	Nurse	Med.	Mix	144.5	53.7	12	50	MD	2
M-2	25	M	Hi.	Edu.	High	V	174	77.5	19	79.17	U	3
M-3	32	M	Hi.	Peon	Low	Mix	173	75.7	18	75	U	2.9
F-2	39	F	Hi.	Nurse	Med.	Mix	147	61	13	54.17	MD	2.1
F-3	27	F	Hi.	Edu.	High	V	161	67	18	75	U	2.2
F-4	26	F	Hi.	Edu.	High	V	152	59	18	75	U	2
F-5	25	F	Hi.	Edu.	High	Mix	157	49.3	15	62.5	MD	1.9
F-6	26	F	Hi.	Edu.	High	Mix	150	44.1	14	58.34	MD	1.9
M-4	37	M	Hi.	Peon	Low	V	165	72.9	16	66.67	MD	2.7
F-7	40	F	Hi.	Peon	Low	Mix	140	50.8	14	58.34	MD	1.9
F-8	28	F	Hi.	Edu.	High	Mix	145	39.5	12	50	MD	1.7
M-5	26	M	Hi.	Edu.	Med.	Mix	175.5	55.4	14	58.34	MD	2.5
F-9	40	F	Hi.	Peon	Low	Mix	148	62.3	13	54.17	MD	2.1
M-6	34	M	Hi.	Peon	Low	Mix	165	68.5	14	58.34	MD	2.8
M-7	44	M	Hi.	Peon	Low	Mix	155	61	14	58.34	MD	2.3
M-8	40	M	Hi.	Clerk	Med.	V	174	56	16	66.67	MD	2.1
F-10	45	F	Hi.	Peon	Med.	Mix	156	53	14	58.34	MD	1.9
M-9	40	M	Hi.	Peon	Med.	V	170	74.6	18	75	U	2.8
M-10	29	M	Hi.	Clerk	Med.	Mix	169	55.4	15	62.5	MD	2.4
M-11	38	M	Hi.	Clerk	Med.	V	154	47.2	13	54.17	MD	2.1
M-12	25	M	Hi.	Edu.	High	V	172	76.7	15	62.5	MD	3
M-13	26	M	Hi.	Edu.	High	Mix	166	67.3	14	58.34	MD	2.6
M-14	25	M	Hi.	Edu.	High	Mix	180	66	18	75	U	2.9
F-11	30	F	Hi.	Service	Med.	V	150	44.1	15	62.5	MD	1.8
M-15	31	M	Hi.	Peon	Low	Mix	162	59.1	12	50	MD	2.4
F-12	27	F	Hi.	Clerk	Med.	V	153	57	18	75	U	2
F-13	38	F	Hi.	Peon	Low	Mix	161	75	16	66.67	MD	2.4
M-16	27	M	Hi.	Peon	Low	Mix	164	72.2	19	79.17	U	2.7
M-17	25	M	Hi.	Edu.	High	Mix	177.5	71.2	17	70.83	MD	2.9
F-14	32	F	Hi.	Service	Med.	Mix	139	56.7	12	50	MD	2
F-15	30	F	Hi.	Nurse	Med.	Mix	155	49	14	58.34	MD	2
F-16	45	F	Hi.	Peon	Low	V	157	60.2	12	50	MD	1.9
F-17	41	F	Hi.	Clerk	Low	Mix	152	51.9	14	58.34	MD	2
F-18	29	F	Hi.	Nurse	Med.	Mix	152	61.4	16	66.67	MD	2.1
F-19	33	F	Hi.	Nurse	Med.	Mix	139	70.9	15	62.5	MD	2.1
F-20	36	F	Hi.	Nurse	Med.	Mix	149	40.8	15	62.5	MD	1.8
F-21	36	F	Hi.	Peon	Low	Mix	152	67.3	15	62.5	MD	2.2
M-18	35	M	Hi.	Peon	Low	V	162.5	62.8	16	66.67	MD	2.5
M-19	37	M	Hi.	Tech.	Med.	Mix	169	78	19	79.17	U	2.9
M-20	26	M	Hi.	Edu.	Med.	Mix	168	53.9	18	75	U	2.4
F-22	36	F	Hi.	Nurse	Med.	Mix	150	55	13	54.17	MD	2.1
F-23	27	F	Hi.	Edu.	High	Mix	155	52.2	13	54.17	MD	1.9

ID. No.	Age	sex	Reli.	Occu.	Eco. Stat.	Diet	Ht.	Wt.	A-S Score	A-S %	A-S	Bone- Mass
M-21	45	M	Hi.	Clerk	Med.	V	168	67.1	12	50	MD	2.7
M-22	28	M	Hi.	Clerk	Med.	Mix	172	75	18	75	U	2.9
M-23	30	M	Hi.	Clerk	Med.	Mix	171	76.7	18	75	U	3
M-24	35	M	Hi.	Driver	Med.	Mix	169	74.3	18	75	U	2.7
F-24	30	F	Hi.	Nurse	Med.	Mix	146.5	53	13	54.17	MD	1.9
F-25	33	F	Hi.	Service	Med.	Mix	157	50	15	62.5	MD	2.1
M-25	33	M	Hi.	Peon	Low	Mix	154	40.3	12	50	MD	2.1

c) Case Paper Proforma:-

**Department of Sharir Kriya (Post Graduate)
(Affiliated to M.U.H.S. Nashik)**

Case Paper Proforma

Title of Study - "Study of Asthi-Sarata vis-à-vis Bone- Mass".

ID. No.	:
Serial No.	:
Name	:
Address	:
Age	:
Sex	:
Religion	:
Occupation	:
Economical Status	:
Height	:
Weight	:
Bone Mass	:
Anguli Pramana (cm)	:

Asthi-Sarata Examination

Sr.No.	Body parts	Measurements in cm	By examination Anguli Pramana	Score
1	Parshni			
2	Gulpha			
3	Janu			
4	Aratni			
5	Jatru			
6	Chibuka			
7	Shira			
8	Parv(manibandh sandhi)			
9	Asthi (jangha)			
10	Skandha			

11) Can you remain physical active for whole day? (Kriyavanta).

(दिवसभर तुम्ही शारीरिक दृष्टी कृती मील असता का?)

i) Yes ii) No (Yes=1)

12) Can you sustain physical hardship for a longer duration without rest? (Kleshsaha).

(दीर्घकाळ कष्टाची कामे किंवा वाटचाल केल्यावर विश्रांती पाहिजेच असे वाटते का?)

i) Yes ii) No (Yes=1)

13) Do you remain energetic through out the day? (Mahotsaha).

(अ आवेली विश्रांती नसली तरी उत्साहाने कामे सुरू ठेवता येते काय?)

i) Yes ii) No (Yes=1)

14) Do you have any history of fracture of bones after a minor trauma or accident? (Sar-sthir-sharir).

(किरकोळ अपघाताने (पडने वाहनाचा धक्का लागणे) हाडे मोडली काय?)

i) Yes ii) No (No=1)

15) How is the growth of nails? (Quality of mala).

(नखांची वाढ क ती आहे?)

i) More ii) Less (More=1)

16) How is the growth of hair? (Quality of mala).

(केसांची वाढ क ती आहे?)

i) More ii) Less (More=1)

17) Whether nails are thick or thin in texture? (Quality of mala).

(नखे जाड आहेत की बारीक ?)

i) Thick ii) Thin (Thick=1)

18) Whether hairs are thick or thin in texture? (Quality of mala).

(केस जाड आहेत की बारीक ?)

i) Thick ii) Thin (Thick=1)

19) Whether the person complains of hair fall or splitting of hair? (Quality of mala).

(केस गळणे किंवा फुटीरता आहे का?)

i) Yes ii) No (No=1)

20) Whether the person complains of brittleness of nails? (Quality of mala).

(नख फुटीरता आहे का?)

i) Yes ii) No (No=1)

21) Whether dentition started at proper age?

(लहानपणी दात लवकर (वेळेत) आले काय?)

i) Yes ii) No (Yes=1)

22) Whether the person has healthy teeth? (e.g. Without caries).

(दात निरोगी (किडलेले, हालणारे) आहेत का?)

i) Yes ii) No (Yes=1)

23) Whether all joints are having a bigger dimension? (Length, breadth, circumference).

(सर्वच सांधे मोठ्या आकाराचे आहेत का?)

i) Yes ii) No (Yes=1)

24) Whether the person is heighted, strong and stought? (Personality).

(रीरयष्टी धिपाड, मजबूत, रुंद आहे का?)

i) Yes ii) No (Yes=1)

Score (out of 24) :-

Asthi-sarata percentage :-

Asthi-sarata :- Uttam /Madhyam / Heen.

लिखित संमती पत्रक

क्र.

नाम:

दिनांक:

वय:

लिंग:

"Study of **ASTHI-SARATA** vis-à-vis **BONE-MASS**."

१] मी या पत्रकाद्वारे असे नमुद करतो/करते कि, मी दिनांक _____ रोजी या प्रक्रियेसंदर्भातील सर्व माहिती वाचली असून त्याबद्दल उपस्थित झालेल्या सर्व ांकांचे निरसन करण्यासाठी प्र न विचारण्याची संधी मला मिळाली आहे. त्यामुळे सर्व मुद्दे मला समजले असून ांकांनिरसन पूर्ण झाले आहे.

२] तसेच मी हे देखील जाणून आहे की ह्या प्रक्रियेमधला माझा सहभाग कोणत्याही क्षणी रद्द करू ाकतो/ ाकते. त्याकरिता मला कोणतेही कारण देण्याची गरज नाही व त्यामुळे माझी कोणतीही वैद्यकिय सेवा किंवा कायदे ार न्यायविषयक अधिकार यांचे हनन होणार नाही.

३] मला अभ्यासक, अभ्यासकाठी काम करणारे इतर लोक व परीक्षक ह्या लोकांना, माझे संबंधित नोंदी पहाण्यासाठी माझी संमती घेण्याची आव यकता नसेल. मी प्रक्रियेमधून माझा सहभाग काढून घेतल्यानंतर देखील या प्रबंधासाठी किंवा इतर संबंधित अभ्यासासाठी माझ्या ा संबंधित नोंदी माझ्या संमती िवाय पडताळल्या जाऊ ाकतात याची मला जाणीव असून माझी पूर्ण संमती आहे.

४] तसेच मला याची कल्पना आहे कि, माझी ओळख पूर्णता गोपनीय राखली जाईल. माझ्या नोंदी इतर कोणत्याही अभ्यासविषयक कामासाठी किंवा प्रका ानास देताना माझी ओळख पूर्णतः गोपनीय राखली जाईल. या नोंदी कोणत्याही ास्त्रीय दृष्टिकोणातून वापरण्यात मी अडवणूक करणार नाही.

वरील सर्व गोष्टी मला समजल्या असून मी स्वखु ाने संमती देत आहे.

सही

साक्षांकिताची सही व नाव

गेध प्रबंधकाची सही